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BY

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INTRA-OCULAR ENCHONDROMA, OF TWENTY-TWO YEARS' GROWTH,

REMOVED AT THE BALTIMORE EYE AND EAR INFIRMARY.

By J. J. CHISOLM, M.D.,
Clinical Professor of Eye and Ear Surgery in the University of Maryland.

WITH A DESCRIPTION OF THE MICROSCOPIC CONDITION OF THE TUMOR.

By H. KNAPP, M.D.,
OF NEW YORK.

S. H. V———, of Virginia, aged twenty-five, was born a healthy infant. At the age of three years his parents noticed a difference in the size of his eyes, the left one being slightly enlarged. Upon further examination and by the use of tests, the sight in it was found defective. Prior to this discovery both eyes were supposed to be perfect. From that period until the present, covering an interval of twenty-two years, the left eyeball has continued steadily to increase in size, at times accompanied by pain. He has been pursuing the avocation of a farmer, and continued work until he left home to seek surgical advice. In his desire to get rid of this projecting and horrible deformity he entered the Baltimore Eye and Ear Infirmary for surgical treatment.

His general health is good, height 5 ft. 10 in., weight about 130 lbs. The right eye is perfect. In the place of the left eye, a rounded mass protrudes (see figure, from a photograph), which seems to be as large as the fist. After appar-

ently filling the orbital cavity, the growing tumor has gradually projected forwards until it has attained a prominence of 2½ inches from a level of the face, having about the same dimensions of 2½ inches in its vertical and transverse diameter. An immensely expanded, hypertrophied, and movable upper lid, as a broad curved belt, covered the upper three-fourths of the free surface of the projection. In this overgrown lid the orbicular muscle was well developed, as indicated by the numerous crescentic ridges which encircled the facial base of the tumor, and which were made prominent through the subcutaneous bundles of muscular fibres. On the upper and outer surface of the tumor, apparently under the thickness of the lid substance, was an elastic, soft swelling, supposed to be the lachrymal gland, pushed out of its natural site, and drawn forward by the growing mass. The mucous or conjunctival tissue covering the exposed face of the tumor was thickened, but was otherwise apparently healthy, possessing the usual mobility of this membrane over the sclerotic coat of the eye. The lower conjunctival cul-de-sac had been effaced in the continued requirements of the enlarging growth, so that the Meibomian edge of the lower lid was directly continuous with the conjunctival covering of the tumor. The upper conjunctival cul-de-sac had not been altogether obliterated, but remained as a very superficial groove separating the edge and inner surface of the upper lid from the anterior surface of the protrusion. Under the ocular conjunctiva, which, although thickened, was still translucent, an appearance of healthy, white sclerotic was visible. All traces of corneal tissue had disappeared, and in its stead was a thick, red conjunctiva, covering which were crusts of desiccated mucus. From this fleshy surface he reports that several serious hemorrhages have from time to time taken place. Of this serious complication I could detect no evidences, as there was no appearance of ulceration when the anterior surface of the tumor was exposed by the removal of the mucous crusts. There were no large vessels visible on the surface of the tumor.

The entire anterior and exposed face of the growth was kept constantly bathed by an abundant lachrymal secretion, which, in a certain oblique light, could be seen oozing from beneath the upper lid, from the direction of the soft, elastic swelling already noticed as lying upon

the upper and outer surface of the tumor, and supposed to be the lachrymal gland.

The long-continued pressure of this ever-slowly increasing growth had caused, by absorption, an increase in size and a change in direction of the outer border of the orbit. It had also in a measure displaced the nose from its median position. After leaving the orbit the growth had not spread out suddenly, becoming bulbous, but had retained a uniform diameter in every direction of about two inches and a half, which measured the degree of expansion of the orbital opening.

The whole tumor, which was uniformly ovoidal in shape, *possessed limited movements, synchronous with those of the sound eye.* When firmly held and a to-and-fro movement imparted to the hand, similar movements were extended to the growth. Careful palpation elicited no fluctuation, although a decided feeling of elasticity pervaded the entire tumor.

The *history, symptoms, and appearance of the projecting mass indicated an intra-ocular tumor* of very slow growth, which, after twenty-two years of steady increase, was still incarcerated within the chambers of the eye, and isolated by the much expanded and thickened, but, to all appearances, otherwise normal sclerotic coat. Believing that the eye was the seat of a malignant growth, which, from some unexplainable cause, had taken on a very irregular and unusual development, its extirpation was advised and assented to. The operation, which was performed under chloroform, in the presence of Prof. Gross, of Philadelphia, and others, was similar to the ordinary enucleation so familiar to ophthalmic surgeons. After extending the outer canthus, on account of the great size of the tumor, the conjunctiva was incised around the former site of the cornea, the tenotomy of the various muscles was easily effected, and after passing a long, heavy scissors, curved on the flat near the point, to the very apex of the conical cavity of the orbit, the optic nerve was divided, and the whole mass at once glided out of the socket, leaving a huge but apparently healthy cavity, devoid of all fat and lined from rim to apex with a thickened periosteum. Hemorrhage, not excessive, was readily controlled by sponge pressure.

The case made good progress for the first few days. On the fourth

night from the operation there was a hemorrhage of a few ounces. On the fifth night this was again repeated without the source of hemorrhage being discovered. On the evening of the ninth day a very severe hemorrhage took place, which was deemed sufficiently serious to warrant me in ligating the common carotid. On the morning of the tenth irregular tetanic symptoms supervened, and he died on the fourth day after the ligature had been applied. There had been no recurrence of the hemorrhage.

The mass removed was a smooth, regularly ovoidal tumor, about three and a half inches in its longest diameter, corresponding with the axis of the orbit, and two inches and a half in its vertical and transverse diameters. Its outer surface was the expanded and thickened sclerotic coat of the eye, which apparently had not been broken through at any point by the growth from within. To this outer surface were attached the muscles of the eyeball. When the tumor was laid open the whole sclerotic sac was found filled with a solid contents, mottled in appearance, and of varied consistence, among which were conspicuous white nodules of different sizes. These proved upon section to be cartilage, which character was confirmed by microscopic examination.

It is so very unusual to find cartilage in the growths within the eyeball, that this rare specimen of tumor was deemed worthy of a more careful examination. Prof. H. Knapp, a recognized authority on intra-ocular growths, has very kindly consented to make the examination for me, and to him are we indebted for the following carefully prepared and most valuable report of this rare pathological specimen:—

ANATOMICAL EXAMINATION OF THE PSEUDOPLASM.

The tumor (Fig. 1, Tab. A), hardened in Mueller's fluid, was roundish, having a diameter of two inches and a half. It was surrounded by connective tissue in the form of an irregularly dense *capsule* (Fig. 1, *a*). On the transverse section its bulk consisted of *hard nodes* (Fig. 1, *b*), separated from one another by *fibrous tissue* connecting with the capsule. A considerable portion of the tumor, about one-fifth of its size, was softer and had a *fibro-granular* appearance (*c*).

The enveloping *capsule* consisted in its outer part of dense undulating and parallelly striated connective tissue, containing a very scanty amount of cells and blood-vessels. Its similarity with the structure of the sclerotic was marked. The inner layers of the capsule had more blood-vessels and cells, and the layer near the nodes was filled with small round formative cells, scattered sparsely through the fibres; besides them smaller and larger cells lay together in spindle-shaped spaces between the bundles of fibres. These layers, therefore, presented the connective tissue in the state of growth or proliferation.

The *fibro-granular* part (*c*) of the tumor showed a net of connective-tissue fibres (Fig. 2) which was freely traversed by blood-vessels (*v*), and abundantly interspersed with formative cells (*f*). In addition to these elementary parts this portion of the tumor contained a good deal of fat, in the form of globules (*m*), and granulated bodies (*g*). Teased preparations of this substance showed long fibres with double outlines (*o*), spindle-shaped (*s*), stellate (*h*), and small round

cells (*r*), the latter here and there in dense clusters (*u*).

The structure of the hard *nodes* discovered the two varieties of *cartilage*, the *hyaline* and the *fibrous*, in very characteristical pictures. The *hyaline* variety (Figs. 3, 4) prevailed over the fibrous (Fig. 5). It consisted of a yellowish, homogeneous, or very finely granular, glassy-looking matrix—intercellular substance—in which cartilage-cells of different forms were embedded. Oval cells with one or two nuclei (Fig. 3, *a*); small, round, oval and irregular spaces containing three and more nuclei (*b*); large, irregular cavities densely filled with nuclei (*c*), and free nuclei (*d*), were promiscuously placed in the homogeneous hyaline basis-substance. In many places the matrix appeared interspersed with free nuclei alone (Fig. 4). Part of the nuclei were small, round and pellucid (*d*); another part were small and shrivelled up (*b*); others (*cd*) large, oval, round, club-like, dumb-bell shaped or irregular. Their interior was either homogeneous and transparent (*c*), or finely or coarsely dotted (*d*).

The *fibrous portion of the cartilage* (Fig. 5) showed an irregularly striated matrix in which the same cellular elements were embedded as in the hyaline portion. Where the nuclei predominated (*a*), the matrix had commonly a granular appearance, with fine, short lines; where the larger cells were prevalent (*b*), the matrix was markedly fibrous.

Blood-vessels ran in different directions through the fibrous part, but were absent in the hyaline portion.

From the foregoing description it is evident that the

tumor was, as Dr. Chisolm declared it to be, an *enchondroma.* There is, further, no doubt that it was, from beginning to end, an *intra-ocular* growth. The history showed the gradual enlargement of the eyeball, together with failure of sight. Had the enlargement been only apparent, due to exophthalmus, in consequence of an orbital tumor, no impairment of sight would have been noticed at the outset of the difficulty, for we see the protrusions of the eye reach very high degrees before the vision becomes impaired. The fact that the sclerotic coat, before and after the operation, was seen to envelop the growth; furthermore, the movements of the tumor concomitant with those of the other eye; the insertions of the ocular muscles into the surrounding coat—sclerotic; their division in the enucleation of the eye; the gliding of the whole mass out of the orbit after the muscles and the optic nerve had been severed:—all these circumstances show *that the growth was within the eye.* As far as I can ascertain, this case is the only one of its kind on record. I have consulted many older and modern works on morbid growths, as well as the text-books of ophthalmology, without finding a mention of intra-ocular enchondroma.

As this case introduces a new species of tumor into the field of ophthalmology, I have endeavored not only to *define its character,* but to *trace its origin and development.* If we look for analogy, and remember that cartilaginous tumors, though originating mostly in the bone and periosteum, not infrequently arise from the connective tissue of other organs, especially the fasciæ, (for instance in the parotid gland), we may assume that

the tissue in which, most likely, the above-described enchondroma took its first root, was the *sclerotic.* The exceedingly slow increase of the tumor also favors the theory that it started from the sclerotic, a tissue which, containing but a few blood-vessels, could only furnish a scanty supply of nutritive material to the pseudoplasm. We know, however, that chondromata in general are of very slow growth. The majority of them, like the present case, are first noticed in early youth; some are congenital. The sclerotic could be recognized in this specimen with the microscope. Its outer layers appeared as usual, but the inner were infiltrated with nuclei and cells of an indifferent character, such as are found at the border of every growing neoplasm. Near by lay hyaline cartilage. There was, therefore, an immediate transition between the sclerotic and the tumor, indicating either that the cartilaginous tissue grew *from*, or grew *into* the sclerotic. The correctness of the latter view was borne out by the fact that I saw here and there stellate and angular pigment cells crowded into the sclerotic tissue. All who are familiar with intra-ocular neoplasms know how the pigment cells of the choroid move when this membrane itself is destroyed. They follow the course taken by the proliferating new elements. In spite of this, I think that the enchondroma originated in some part of the inner layers of the sclerotic, spread toward the vitreous, destroyed every tissue within the eyeball, and, after filling the globe completely, began to press and encroach upon other parts of the sclerotic, gradually expanding it by its steady increase. Thus the choroidal pigment may have

been carried with the newly-formed cells into the sclerotic when they reached and invaded the opposite side of the eyeball.

There was no indication of a special *cause* for the development of this growth. C. O. WEBER, in his statistics of 237 cases of enchondroma (*Die Knochengeschwülste*, Bonn, 1856, p. 138), showed that in about half the cases where a history was given, an injury was the cause of the chondromatous growth.

R. VIRCHOW assumes (*Morbid Tumors*, 1, p. 505) that the enchondromata of the soft parts commonly originate in the interstitial connective tissue, in which "chronic inflammatory, or at least irritative" conditions lead to the new formation of connective tissue, which is the matrix of the enchondroma. The cellular elements of the connective tissue multiply by division, the intercellular substance becomes denser and more abundant, the cells are surrounded with capsules, and the cartilage is formed (Virch., l. c., p. 506).

In the case above described there was no history of a trauma. Without any inconvenience to the patient, or irritation of the eye, the globe was noticed to enlarge, sight failing, and a white reflex shining through the pupil. This evidently was caused by newly-formed tissue in the posterior part of the eye. No other than connective and cartilaginous tissues being present in our specimen, we have no reason to disagree with the great pathologist, but may assume that the first step of the pseudoplasm was new formation of connective tissue. This we find well marked in the outer layers of the specimen, from which it runs through the tumor in

various directions, forming septa between the nodes (*d*, Fig. 1), and accumulating in larger quantity in the soft portion (*c*, Fig. 1). There is still, as we have seen, an active proliferation going on in this connective tissue (Fig. 2), resulting not only in its increase, but in its conversion into cartilage. In the outer layers of the capsule nothing is found but undulating and parallel fibres, interspersed with some nuclei; in the inner layers and the septa arising from them, the nuclei become more and more numerous, and their gradual conversion into cartilage cells can be easily observed. In the softer places of the granular portion there is a network of delicate fibres, containing nuclei and small cells (Fig. 2), but in the denser places of the granular portion the cells become larger, obtain a double outline, and one or several distinct nucleoli (Fig. 7). At some points the cells lie isolated between the nuclei and fibres of the connective tissue; at others crowded together and forming clusters walled in by a fibrous capsule (Fig. 7, *d*). Two and more cells very frequently are found in the same capsule (Fig. 7, *a*, *c*, *d*). The fibres in the basis-substance have become coarse. Thus we see fibrous cartilage at the side of proliferating connective tissue in the same microscopic field of vision (Fig. 6). In some places there are smaller and larger accumulations of cartilage cells, surrounded by connective tissue which is but little changed (Fig. 7). Such accumulations are the starting points of new nodes of the growth, which, itself, is but an agglomeration of many separated or coalescent nodes (Fig. 1).

Whereas the development of the *fibrous cartilage*

could be clearly demonstrated to consist in a *gradual conversion of the connective tissue* elements (Fig. 7), the *hyaline cartilage* showed *different modes of development.*

(1.) The *isolated clusters of cartilage cells* above mentioned (Fig. 7), formed the *nuclei of hyaline nodes*, being distinguished from the cells of the fibrous cartilage by their yellow color and lustrous appearance. The deposition of hyaline intercellular substance completed the formation of true cartilage (Fig. 7, *b*, *c*). These yellow clusters may be likened to seeds strewn into the young connective tissue, which they gradually absorb by their own growth. Some of them contain only a few cells, but have, nevertheless, thick capsules, and represent simple breed-cells (Fig. 7, *a*); others are compound clusters, consisting of a varying number of smaller clusters and isolated cells enclosed in a common large capsule (Fig. 7, *c*, *d*). The microscopic picture of these compound clusters nearly resembles the macroscopic appearance of the whole tumor (Fig. 1). The growth of the neoplasm by proliferation of cells is distinctly visible in these clusters. The matrix in which they are embedded is provided with blood-vessels, which I did not see enter into one of the clusters. In some places there were embedded into the fibrous basis-substance larger *granular bodies* (Fig. 7, *e*), which do not exactly resemble the accumulations of granular fat, the dots varying too much in size, being dark throughout, viz., without a transparent centre, and irregular in outline, unlike the little circles with white centres which compose the globules of granular fat. Here and there a

nucleus was surrounded by similar dark granules (Fig. 6, *a*), resembling a coarsely granular cell body, around which no membrane was visible.

2. *The fibrous cartilage was converted into hyaline cartilage by gradual extension of the hyaline basis substance into the fibrous matrix of the fibro-cartilage.* There were numerous yellow patches of true cartilage scattered through the fibrous cartilage. The line of transition between the two was ill-defined and often imperceptible. *The hyaline cartilage, in its growth, absorbs the fibro-cartilage as well as the connective tissue.*

3. *Agglomerated formative cells were directly converted into cartilage cells by diffuse deposition of hyaline substance.* To a large extent, especially in preparations taken from the larger nodes of the specimen, the structure of this pseudoplasm presented a dense accumulation of nuclei, or small round cells, resembling medullary tissue, for instance, glioma (Fig. 8). These small, round, formative cells (*a*, Fig. 8) were mostly of the same size, finely granular, pellucid, and colorless. Some had distinct nucleoli, others had none. Their contour was always well defined. They were pervaded, in most places, by an irregular network of, mostly, coarse fibres (Fig. 8, *b*). In the immediate vicinity of this white medullary tissue, yellow, pellucid, faintly-lustrous, small and large patches (*d*, Fig. 8) appeared, which contained the same kind of cells, embedded in hyaline intercellular substance; some of these cells, however, were shrunken. These hyaline patches extended in irregular lines (*c*, Fig. 8) into the medullary structure,

communicated with one another, broadened, and encompassed smaller and larger irregular spaces, which were densely filled with formative cells. Where the deposition of hyaline substance had only begun, its border line was commonly ill-defined, as in Fig. 8; but where it had advanced further, its boundary was sharp, and the enclosed spaces resembled breed-cells, as *b* and *c* in Fig. 3, and *e* in Fig. 4. Following these patches up a greater distance from their boundary lines, I found that the small round cells—or nuclei—enlarged, became oval, had one or several distinct nucleoli; obtained body—cell contents—and capsules around them, multiplied their nuclei, and aggregated in clusters, thus exhibiting all the features of true cartilage.

The more I studied the histology of this specimen—and I employed a good deal of time at it—the more I was convinced that the increase of the tumor was less effected by multiplication of cartilage cells in the way of cell division, but by the conversion of formative cells into cartilage cells. This process was very active, both in the fibrous and the hyaline portions of the pseudoplasm. The formative cells were either sparsely strewn into the connective tissue, or so densely crowded together that they recalled the structure of marrow, or encephaloid tumors; but here and there they were surrounded by hyaline substance, which could be easily recognized by their yellow color and lustrous appearance. Thus, as in the growth of other tumors, so in that of enchondroma, the formative cell plays the most important part.

In regard to its clinical importance, the specimen

above described must be pronounced an *innocent or benign growth.* Though in very rare instances metastatic cartilaginous tumors have been observed (PAGET, VIRCHOW), there was no indication of malignance in this case. The tumor was, moreover, completely encapsuled, even after having destroyed the eyeball long before. Its first appearance in early youth, and its slow growth, are features which it had in common with chondromatous neoplasms in general.

As an *intra-ocular tumor, it is novel and unique.* The few cartilaginous tumors to be found in ophthalmological literature were located either on the outside of the sclerotic and cornea (VON GRAEFE and SCHWEIGGER, *Arch.* vii. 2, p. 5), or in the orbit (FANO, *L'Union Médicale,* 1859, t. iii., p. 557, reprinted in *Demarquay's Tumeurs de l'Orbite,* p. 365, and MACKENZIE, *Treatise,* 4th Edition, p. 330).

The removal of the tumor was indicated, and, if done at an earlier time, would probably not have been followed by after-hemorrhage and its fatal consequences.

I would not omit to thank Prof. Chisolm very cordially for having kindly given me the opportunity of examining so interesting a specimen, which, on account of its rarity, forms a very valuable contribution to the knowledge of ocular tumors. This being the first and only case of its kind ever observed in that locality, I took particular pains to investigate, describe, and illustrate it in such a way as to leave no uncertainty with regard to its nature.

As there are, in reality, no unique cases, I doubt not

that this observation of an intra-ocular enchondroma will soon be followed by others. H. KNAPP.

NEW YORK, Nov. 7, 1872.

EXPLANATION OF THE DRAWINGS ON PLATES A AND B.

Fig. 1. *Section through the Enchondroma.*
- *a.* Fibrous capsule.
- *b.* Hyaline nodes.
- *c.* Fibro-granular substance.
- *d.* Fibrous septa between nodes.

Fig. 2. *Proliferating connective tissue and its elementary parts.*
- *g.* Fat in granulated bodies.
- *f.* Formative cells.
- *m.* Fat in isolated globules.
- *t.* Net of connective-tissue fibres.
- *v.* Blood-vessels.
- *o.* Long fibres with double outlines.
- *s.* Spindle-shaped, *h*, stellate, and *r*, small round cells.
- *u.* Small round cells in clusters.

Fig. 3. *Hyaline cartilage.*
- *a.* Oval cell with two nuclei.
- *b.* Smaller irregular spaces containing several nuclei.
- *c.* Large irregular cavity densely filled with nuclei.
- *d.* Free nuclei.

Fig. 4. *Hyaline Matrix interspersed with free nuclei.*
- *d.* Nuclei, small, round, and pellucid.
- *b.* Nuclei, small and shrivelled.
- *c.* Nuclei, large, oval, round, club-like, dumb-bell-shaped, or irregular.

Fig. 5. *Fibrous cartilage.*
- *a.* Nuclei in a granular or finely striated matrix.
- *b.* Larger cells in a coarsely fibrous matrix.

Fig. 6. *Fibrous cartilage developing from proliferating connective tissue.*
- *a.* Nucleus surrounded by dark granules.

Fig. 7. *Smaller and larger accumulations of cartilage cells in connective tissue.*

a. Simple breed-cells.

b, *c.* Deposition of hyaline substance around the cells.

d. Large capsule.

e. Coarsely granular bodies.

Fig. 8. *Agglomerated formative cells, converting into hyaline cartilage.*

a. Small round pellucid cells, densely accumulated, as in medullary tissue.

b. Network of coarse fibres pervading the cells.

d. Yellow, pellucid, and faintly-lustrous patches, extending

c. in irregular outlines into the medullary tissue.

ERRATUM: The small letter *a* on the left border of Fig. 8 should be *d*.

LEPTOTHRIX IN THE UPPER CANALICULUS.

By Dr. EMIL GRUENING,

of New York.

(See Table C, Figs. 1–4.)

In 1854, Von Graefe described the first case of fungoid concretions in the lower canaliculus.* Within the subsequent period of fifteen years, from 1854 to 1869, Von Graefe noted nine additional cases of this kind.† An accurate microscopical examination of these concretions was first made by Cohnheim in 1865, who found them to consist of leptothrix elements.‡ Besides the ten cases reported by Von Graefe, Förster's case of leptothrix masses in the lower canaliculus is known.§ Quite recently Schirmer, of Greifswald, published a case, demonstrating the existence of this fungus in the *upper* canaliculus.‖ The following case, in all respects similar to Schirmer's, is the second on record :—

An Irishman, fifty years of age, who was treated at the New York Ophthalmic and Aural Institute for chronic conjunctival catarrh and epiphora of the right eye, presented himself in May, 1872, with an acute inflammatory intumescence of the caruncle, semi-lunar fold, adjacent conjunctiva, and a cylindrical swelling along the course of the right upper canaliculus. The upper punctum was considerably en-

* Arch. f. O. I. 1. p. 284. † Arch. f. O. XV. 1. p. 324.
‡ Arch. f. O. XV. 1. p. 326. § Arch. f. O. XV. 1. p. 318.
‖ Klin. Monatsbl. f. Augenheilk. 1871, p. 248.

larged, crater-shaped, and the corresponding portion of the lid everted. On raising the lid from the eye-ball and compressing the tumor between the thumb and fore-finger, a scanty drop of a viscid, yellowish, pus-like substance made its appearance at the punctum. After wiping away this substance the pressure was continued, without, however, effecting a further discharge. The tumor had not diminished in size. The region of the lachrymal sac was intact. *Mutatis mutandis*, the ensemble of the disease corresponded so perfectly with Von Graefe's description of leptothrix in the lower canaliculus, that the diagnosis of fungi in the upper canaliculus was not difficult.

Prof. Knapp examined the patient subsequently, made the same diagnosis, and slit the canaliculus with Weber's knife. The calibre of the tube was found to be enormously distended. With the aid of Daviel's spoon, five yellow, roundish concretions, severally of the size of a pin's head, were removed. The masses had an uneven surface and were of soft consistence. The aperture leading into the lachrymal sac was obliterated. The patient refused to have it opened. After a few days all the inflammatory symptoms of the right eye had subsided; the epiphora had not diminished.

On microscopical examination the concretions were found to be opaque, owing to their impregnation with chalky particles. These readily dissolved in dilute hydrochloric acid. The leptothrix elements then came into view in the shape of long filaments and rods (Fig. 1. Tab. C), which, on adding iodine, assumed a light blue tinge. In this reaction they differed from the leptothrix masses of the lower canaliculus examined by Leber and Waldeyer, who never observed a similar coloration.

Hallier's observations on the morphological relations of penicillum glaucum and leptothrix* induced me to cultivate the fungi removed from the upper canaliculus.

Two shallow glass cups were half filled with glyce-

* Mohl und Schlechtendahl's *Botanische Zeitung*, 1866, N. 23, p. 187.

rine. Into one of these I threw several fragments of a finely divided leptothrix concretion, and, in order to exclude the air, covered both cups with heavy glass plates. The fragments sank immediately to the bottom of the cup. The next day every leptothrix particle was found to be surrounded by a very delicate, whitish, gossamer-like zone. Twenty-four hours later these zones had considerably increased in size. They extended to the surface of the glycerine and here passed into a thick, bluish-green layer. The microscopical examination revealed that the delicate, gossamer-like substance consisted of filaments of penicillum (Fig. 2, *b and c;* Fig. 3), the greenish-blue layer of pencil spores (Fig. 4).

The glycerine of the other cup was very carefully examined with the microscope, but no organic elements were detected.

EXPLANATION OF THE FIGURES.—TABLE C.

Fig. 1.—Filaments and rods of Leptothrix canaliculi superioris. Obtained by cultivation of Leptothrix in glycerine:—

Fig. 2.—(*b*) Fragment of a branch of Penicillum. (*c*) Articulated plant of Penicillum.

Fig. 3.—Fragment of branch of Penicillum containing vacuoles.

Fig. 4. Branch of Penicillum with pencil spores.

Magnified 840 *diameters.*

ERRATUM. The first four figures of plate C were drawn by Dr. E. Gruening, the fifth by Mr. Wright, the sixth by Dr. A. Barkan, the seventh only by Dr. H. Knapp, but not the whole plate. By mistake of the lithographer his name alone was placed on the plate.—EDITOR.

SPONGY EXUDATION IN THE ANTERIOR CHAMBER.

By Dr. EMIL GRUENING,

of New York.

Prof. Schmidt, of Marburg, recently described several cases of acute iritis characterized by peculiar and hitherto undescribed exudation masses in the anterior chamber.* He dwells chiefly upon a form of exudation which presents the appearance of a cataractous lens dislocated into the anterior chamber.

Referring to Schmidt's article, Gunning, of Amsterdam, reports three cases in which lens-like exudation masses came under his observation.† Gunning styles this exudation gelatinous, and states that it is poured out into the anterior chamber suddenly and abundantly, and passes away within a few days without leaving any trace.

When I read the description of Schmidt's and Gunning's cases, I was already acquainted with this peculiar exudation, though I had not yet observed it in idiopathic iritis. Prof. Knapp had first called my attention to the occurrence of a certain form of exudation after operations upon the iris. Knapp characterizes this exudation as spongy. About twenty-four hours after

* Klin. Monatsbl. f. Augenheilk., 1871, p. 94.

† Klin. Monatsbl. f. Augenheilk., 1872, p. 7.

an iridectomy, the anterior chamber may be found more or less filled with a brownish shapeless mass, consisting of very fine filaments, crossing each other at various angles, and thus forming an irregular network, which presents a striking resemblance to the gross structural arrangement of a sponge. This spongy exudation either disappears directly in this form, or indirectly—*i. e.*, after having been transformed into a bluish-white, homogeneous, and sharply-defined mass. This observation shows that the gelatinous exudation (Gunning) is in reality a transition stage of spongy exudation (Knapp).

The following case is illustrative of the occurrence of spongy exudation and its consecutive gelatinous stage in syphilitic iritis.

On March 22, 1872, I was called to see Mr. A., aged 40, who for the past few days had been suffering from an inflammatory affection of the right eye.

The patient stated that two years previously he had contracted syphilis, which had manifested itself in the form of a cutaneous eruption, and of iritis of the left eye. He feared that the right eye had now become similarly affected. On examination I found iritis gummosa. Photophobia and lachrymation were excessive. Pain very severe. Pericorneal injection marked. Iris discolored, the inner and outer parts of its pupillary edge broadly adherent to the anterior capsule. From the outer part of the smaller iris circle, near the attached pupillary edge, a gummy nodule of the size of a pin's head jutted into the anterior chamber.

I ordered instillation of atropine, application of leeches to the temple, friction with gray ointment, and made a hypodermic injection of corrosive sublimate.

The next morning I found that the inner synechia had given way, while the outer had not yielded, and the nodule had grown to the size of a split pea.

All the inflammatory symptoms had increased; the pain was excessive.

March 24.—*The anterior chamber is completely filled with spongy exudation*, through which the iris, pupil, and nodule are still discernible. The inflammatory symptoms have not abated.

March 25.—*The exudation appears transformed.* It is bluish-white, homogeneous, like a soft cataract, and above and at the inner side sharply defined by a convex edge, beyond which a crescentic rim of the iris is visible.

The area of the pupil, the greater portion of the iris, and the gummy nodule are hidden behind the mass. No diminution of the inflammatory symptoms.

March 26.—Same condition.

March 27.—Morning. Fœtor mercurialis ex ore and slight ptyalism. *The exudation has disappeared without leaving any trace.* The gummy nodule is reduced to the size of a pin's head. The area of the pupil is free. The patient has no pain, and feels quite well.

March 29.—The gummy nodule has disappeared; the broad synechia, however, resists the action of atropine, and does not yield.

The foregoing case, in many respects similar to Schmidt's and Gunning's cases, is of particular interest: first, on account of the simultaneous occurrence of a gummy nodule and spongy exudation; and, secondly, on account of the observation of the transition of the spongy exudation into the gelatinous.

EXOPHTHALMUS DEXTER APPEARING DURING INCLINATION OF THE BODY FORWARD, AND DISAPPEARING IN THE ERECT POSITION.

By Dr. EMIL GRUENING,

of New York.

The literature of exophthalmus is so exceedingly ample that the publication of additional cases of this affection seems unnecessary. Yet I do not deem it superfluous to make the following case known, as it presents new and hitherto unobserved features, and differs, as regards its origin, from the cases on record. I have searched the literature on this subject very extensively, but have found no mention of an exophthalmus depending *solely* upon an inclined position of the body.

In August, 1871, S. W., aged 45, a teacher of music, was sent to my office by Dr. S. Hahn, of this city. The patient, though weakly built and pale-faced, had always enjoyed good health. He states that five years ago, while engaged in carpeting a floor, in a stooping position, he suddenly experienced a sensation of weight and falling of the right eye. On placing his hand over it, he found that it protruded in reality. He then rose, looked into a glass, but failed to detect any change in the position of the eye. On bending forward to resume his work, he immediately noticed that the eye was again driven out. He remained calm, and after finding that his sight was not materially

impaired, tied a handkerchief over the eye, in order to keep it in place, and quietly finished his work. Since that time the exophthalmus appears during every inclination of the body forward, and disappears in the erect position.

When standing the patient looks somewhat goggle-eyed, especially so on his right side. In the recumbent position the right eye does not stand out beyond the level of the left. Both eyes have a normal range of mobility in all directions. On extreme abduction the outer edge of the cornea reaches the external canthus; on extreme adduction, the inner edge of the cornea touches the caruncle. The examination of the refraction and sight shows R. M. $\frac{1}{4\frac{1}{2}}$, S. $\frac{20}{50}$; L. M. $\frac{1}{6}$, S. $\frac{20}{40}$. The patient reads Jaeger 1 with either eye.

Ophthalmoscopic appearances:—Refracting media clear. Optic discs pale and somewhat atrophic. Extensive staphylomata postica completely surrounding the papillæ. Retinal arteries thin; veins of normal size, but tortuous.

The patient is color-blind. He is neither able to distinguish red and all those colors of which red forms a component, nor its complementary color, green, but appreciates yellow and blue.

Fields of vision of normal extent. No derangement of the heart's action. No enlargement of the thyroid gland. Whenever the patient but slightly inclines his head or body, the right eye is immediately thrust forward. This straightforward protrusion of the eye increases with higher degrees of inclination, and is greatest—measuring 15 millimetres—when the patient bends his body forward and downward in such a manner as to touch the floor with both hands. A horizontal line drawn across the rather prominent bridge of the nose impinges upon the vertex of the cornea. The mobility of the prolapsed eyeball is greatly reduced. It has only a very slight degree of mobility inward, but absolute immobility upward, outward, and downward. Any attempt to evert the eye causes intense pain. Sight and field of vision remain unchanged. On gentle and continued pressure the eyeball recedes into the orbit, but slips out again as soon as the pressure is released. No bruit is heard on auscultation over the right temporal region. No diminution of the exophthalmus noticed after compressing either the right carotid alone, or both carotids simultaneously.

When I related this singular case at the January meeting (1872) of the New York Ophthalmological Society, Prof. Knapp, who at my request had kindly examined the patient, expressed the opinion, that in all probability the protrusion of the eyeball was caused by the gravitation of blood into the pathologically cavernous, retro-ocular tissue of the orbit.

A CASE OF CORECTOPIA.

By THOMAS R. POOLEY, M.D.,

OF NEW YORK,

Ophthalmic Surgeon to Charity Hospital, Assistant Surgeon to the New York Ophthalmic and Aural Institute.

(See Fig. 5, Table C.)

CASES of this anomaly are so rare, and the reference to them so scanty, in recent literature, that no excuse seems necessary for reporting this one. Very few of the text-books even allude to it. Soelberg Wells* gives a brief description of it, and refers to two cases which he had under his care at the Royal Ophthalmic Hospital, occurring in two sisters. In each eye the pupil was displaced (in which direction is not stated), and the lens dislocated, both these conditions being congenital. I have not been able to find any more detailed account of his cases.

Bader† says that displacement of the pupil occurs most frequently upwards. Displacement of the pupil beyond the margin of the crystalline lens has been observed.

Wecker‡ gives a better description of the deformity

* Treatise on Diseases of the Eye, 2d Ed., p. 180.

† The Human Eye: its Natural and Morbid Changes, p. 350.

‡ Maladies des Yeux, Vol. I., p. 404.

than any of the text-books which I have examined. He describes the affection as corectopia, or congenital displacement of the pupil, and considers the condition due to an irregularity in the development of the larger circle of the iris, in such a way that it assumes on one side a normal or excessive size, while on the opposite side, or in some other direction, it is arrested. He refers to the fact that in normal eyes the pupil does not occupy exactly the centre of the iris, but lies a little to the inside or outside of this point.

In cases where the corectopia is very pronounced, not only is the pupil very eccentric, and separated from the adherent border of the iris only by a narrow band of this membrane, but it loses its circular form, becoming oval or lance-shaped. Simple corectopia has no bad effect upon the visual acuteness.

Galezowski* describes this anomaly as characterized by a displacement of the pupil towards the periphery of the iris. He also refers to the deviation of the pupil from the centre of the iris even in normal eyes, and an exaggeration of this condition constitutes corectopia. This irregular conformation of the pupil may be accompanied with other congenital alterations, such as cataract, and luxation of the lens.

Dixon† reports a case of congenital corectopia. The patient, a young man, was a waiter in an inn, and able to attend to all the duties of his business. No examination as to his acuteness of vision was made. In each

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* Traité des Maladies des Yeux, p. 371.

† Royal Ophthalmic Hospital Reports, Vol. I., p. 109.

eye the iris was tremulous. The fibres all radiated in a uniform manner from the pupil to the margin of the cornea. At the inner and lower portion of the anterior chamber, the iris suddenly became a little convex, as if pushed forward by the lens, which had been displaced, in a direction downward and inward. In consequence of the relative position of the pupil and lens, the patient did not look through the latter, but to one side of it. There was no diplopia. The report of the case is accompanied with a drawing, which represents the patient as looking straight forward, the lids being raised to show more distinctly the outlines of the cornea and pupil. The pupils are upward and outward.

In the excellent atlas of Von Ammon* are figured a number of cases of this deformity, representing all degrees of deviation of the pupil from its normal position. The condition is thus described by him: Corectopia is the condition of the iris where one segment is narrower than the other, so that the pupil does not lie exactly in the middle, but more or less to one side. The pupil is most often found in the upper segment of the iris, more seldom downward, or toward the inner side, still rarer is it found outward. With such a congenital displacement, an abnormal form of the pupil is almost always associated (dyscoria); it is angular, jagged, oval, or heart-shaped, its longest diameter being perpendicular, transverse, or oblique. The condition is most common

* Klinische Darstellung der angeborenen Krankheiten des Auges und der Augenlider, p. 36, Tab. ix.

in microphthalmic eyes, and very often there is an abnormal color of the iris, also affections of the lens, or its capsule, so that the entire development of such eyes shows a morbid tendency.

Anatomical examinations of such eyes, until then, had not been made, at least had not been published. The author made an anatomical examination of an eye with corectopia. In this case, the very small round pupil in the left eye of a child was situated downward and inward. The eye was cut through from above downwards, a few lines behind the cornea.

The *corona ciliaris* was well developed; the retina was strongly folded towards the inner side; the central foramen was wanting; the yellow spot oblong, and the plica retinæ well developed. The uvea was very dark; the pupil very small, and its edges were smooth; the region of the ciliary processes was more oblong than circular.

In answering the questions, whether corectopia originates alone, or in connection with dyscoria and polycoria, and whether this condition is to be considered only as an arrest of development or a pathological process as well, we learn from the following, that is to say, we have here a combination of an arrest of development with a pathological process. In the earlier period of development of the eye the iris is wanting; it first appears as a blue and narrow ring, at a time when the choroidal fissure has closed and the ciliary processes have formed. This ring is not of equal width at all points, but is somewhat narrower on the inner side. This peculiarity seems to depend upon the fact that the

growth of the ring is less vigorous from the lower point of closure of the choroidal fissure than from the other peripheral parts of the ciliary body. This may also be the reason why, in a perfectly developed iris, the lower segment is narrower than the upper, and the pupil never lies exactly in the centre. If this peculiar process of development slightly transgresses its limits, it may very well assume a pathological tendency, and cause corectopia in its various grades and with its usual complications, dyscoria and polycoria. Corresponding to the various deviations in the development of the larger circle of the iris, different degrees of corectopia may be determined. GESCHEIDT has designated three varieties. The more strongly marked is the corectopia, the more irregular will the form of the pupil be (dyscoria), which may easily pass into polycoria. As far as Von A. can judge of the origin of the formation of the irregular pupil, he is of opinion that it depends upon arrest of development in the larger iris circle, causing an irregular formation of the parenchyma of the iris, and this again influences the shape of the pupil, and chiefly of the pupillary margin. When there is an excess in the growth of a part of the pupillary margin, forming a tongue-like projection, or a filiform prolongation, reaching to an opposite point of the pupillary margin and coalescing with it, a division of the pupil into two or more openings (polycoria) takes place. The shape of the supernumerary pupil is not circular, but more or less oval, or slit-like: the site of this pupil is variable. These pupils do not lack mobility; they move spontaneously as well as under the influence of belladonna, but

in different degrees; double or triple vision is never caused by them; myopia, however, is generally its consequence.

GESCHEIDT has made some valuable contributions to the knowledge of this subject. Von Ammon refers to his paper on "Irideremia, Irido-schisma, and Corectopia," which was published in Von Walther's and Von Graefe's Journal, vol. xxii., parts 2 and 3. I have not been able to obtain access to these publications myself.

With this brief résumé of the literature of the subject, I will proceed with a description of the case which came under my observation:

The patient, aged thirty-three years, came to the clinic of the New York Ophthalmic and Aural Institute to be treated for a catarrhal conjunctivitis. On looking at him, the deformity which we are about to describe was at once apparent, although it gave him no trouble, nor did he seek advice about it.

In the right eye there was a small, oblong pupil, situated in the lower and somewhat inner segment of the iris, leaving only a narrow rim or margin of iris between the pupillary and ciliary margins (Fig. 5, Tab. C). The iris was of a dark brown color, the same as that of the other eye, and the striæ very distinct. The pupil responded slowly to light and atropine.

The anterior chamber was of normal depth, except, perhaps, in the part corresponding to the natural pupil, where the iris seemed nearer to the cornea than elsewhere. There was a diffuse opacity of the cornea situated directly in front of the pupil. Upon dilating the pupil with atropine the lens was found to be opaque. The opacities radiated from the periphery towards the centre, and the nucleus also was somewhat opaque, but the eye could be sufficiently illuminated to recognize the details of the fundus, which were found normal. There was no microphthalmos; the eye being of the same size and tension as that of its fellow. The right eye was emmetropic; $V = \frac{6}{200}$.

The other eye was normal in every respect, Em. S=$\frac{2}{3}\frac{0}{0}$. He says that so far as he can remember he has never seen well with the right eye. There was a well-defined, narrow arcus-senilis in both corneæ.

In the accompanying figure (5, Tab. C), which was drawn for me by Mr. Wright, the position of the pupil is very accurately shown.

This case is reported more on account of its rarity than for any other reason, and I have very few remarks to offer about it. I may mention that it goes to confirm the opinion of the authors from whom I have quoted, that eyes with corectopia are likely to be abnormal in other respects. It is probable that the cataract in this case was also congenital, as the patient never saw well with the affected eye.

I am inclined to think that the corneal opacity was the result of some inflammatory process, although the patient does not remember ever to have had any trouble with his eyes before. Therefore it too may have been congenital.

EMBOLISM OF A BRANCH OF THE CENTRAL RETINAL ARTERY.

By Dr. A. BARKAN,

of San Francisco.

(See Fig. 6, Tab. C.)

The small number of recorded cases of Embolism of a Branch of the Central Retinal Artery* seems to make it desirable to publish new observations of this affection.

In the beginning of last summer I was consulted by Mira K... ll, the daughter of a wealthy farmer from the southern part of California. She was 26 years of age, unmarried, blond, anæmic, and sickly-looking, and complained of great impairment of sight in her left eye. She stated that she had had scarlet fever when twelve years old. Since that time she had repeatedly suffered from inflammation in her right ankle and knee joints, which always had been connected with considerable swelling and great pain, obliging her to be in bed for a long time. This state had continued until a year previously, when the pain and swelling of the joints had gradually disappeared, and her leg regained its strength and usefulness.

About a month ago she had a pneumonia of moderate intensity, which kept her in bed for two weeks. When she was up the second time, and sat quietly in an arm-chair, without making any bodily or mental effort, she suddenly fainted; and when she came to in a few minutes, *she noticed with terror that she had become blind in both eyes.* Half an hour later the sight rapidly and completely returned in the

* Saemisch and Hirschmann, Zehender's Klin. Mon., 1866, p. 37; Knapp in Arch. of Ophthal. and Otol., Vol. I., No. 1, p. 64.

right eye. The left remained totally blind for a whole hour, after which she could recognize with it large objects near by. Since that time till now two weeks have elapsed, during which no material change in the condition of her eyes has taken place.

Status præsens: The examination of the exterior of both eyes shows no change. The mobility of both eyes is normal. The pupil of the left eye responds readily to bright day-light, though somewhat more sluggishly than that of the right. The tension of the left eye-ball is slightly diminished. Both eyes are emmetropic, R S = 1, L S = $\frac{15}{200}$. A point of the lower half of the retina being used for fixation, the visual field of the left eye shows a defect which occupies its whole lower half. On direct ophthalmoscopic examination the refracting media are clear. A striking difference, both in color and outline, appears between the upper and lower halves of the left optic disc (fig. 6, Tab. C.). While the lower half is yellowish, red, almost hyperæmic, and its margins pass imperceptibly into the adjacent retina, the upper half of the disc is sharply defined, pale, and atrophic.

The condition of the retinal *vessels* is characteristic. The arteries and veins in the lower half of the retina are perfectly normal, with the exception of a small place at a distance of about the length of the diameter of the optic papilla from the lower margin of the disc, in which place the lower arterial branch dips into the tissue of the retina, and becomes thin and indistinct, but reappears after a short interval with distinct outlines and normal calibre (see fig. 6). At first sight there appears to be a scarcity of blood-vessels in the upper half of the retina; but on exact accommodation we recognize, besides the veins, which are straight in their course and somewhat reduced in calibre, also the branches of the central artery in the upper half of the retina. These branches, from their point of emergence, appear thread-like, pale-red, and, in their course through the retinal tissue, bordered by narrow yellowish ribbon-shaped streaks. At the distance of one to one and a half diameters of the optic papilla the arterial branches have become so thin that they can no longer be recognized. The remaining background of the eye, and, in particular, the region of the yellow spot, appear perfectly normal. On moderate pressure on the globe distinct pulsation can be seen in the inferior, but no change in

the superior, arteries. The examination of the heart revealed no disease.

We have evidently to deal in this case with an embolism of the upper branch of the central retinal artery. Although the patient's statement that *both* eyes had simultaneously become blind may not be entirely reliable, we have no reason to doubt that the left eye was totally blind for a whole hour. In all probability the embolus had completely obstructed the calibre of the left central artery during that time, and then was thrust into its upper branch.

The treatment, consisting in two applications of Heurteloup's leech and mild aperients, proved without benefit. Some weeks ago—that is, about ten months after the commencement of the disease—I saw the patient again, and found her sight, the limitation of her visual field, and the ophthalmoscopic appearance of her left eye in the same condition as before.

EMBOLISM OF BRANCHES OF THE CENTRAL RETINAL ARTERY.

By H. KNAPP.

(See Fig. 7, Tab. C.)

THOUGH obstructions of branches of the central retinal artery have only seldom been described, my observation teaches me that they are not so very rare. The unmistakable case of Dr. A. Barkan, reported in the preceding paper of these Archives, induces me to describe three other observations of the same kind, as they are noted in the journal of my private practice:

CASE I. Mrs. Catherine Lambert, of this city, thirty-six years of age, consulted me, May 15, 1871. Five months previously, four weeks before a normal confinement, she experienced, without any other symptoms, a sudden haze before her right eye, which entirely obscured the vision for a few minutes, then rapidly and completely cleared up in the lower half of the visual field of that eye, whilst the upper half remained perfectly dark. Two years previously, shortly before, and soon after the blindness set in, she had attacks of acute pain under her left breast, which her family physician ascribed to pleuritis.

Present condition.—The lower main branch of the central retinal artery of the right eye is like a thin red thread, lined on both sides by a white streak. The secondary branches show the same condition. The red central lines disappear at a short distance from the papilla, while the white streaks remain visible somewhat farther toward the periphery. The arteries in the upper half, and the veins in the whole ophthalmoscopic field of vision, appear normal. The optic disc is red-

dish in its upper, but white and punctate in its entire lower half. The fundus of the right eye, in general, has the same normal appearance in the upper and lower halves; and, moreover, does not differ from that of the left eye, which is normal in structure and function. The upper half of the visual field of the right eye is completely absent, while the vision in the lower appears perfect. She reads Sn XX at 20′ distance with either eye. The sounds of the heart are normal. No other disease than that of the right eye can be discovered. The sight has not changed since the second day after the attack of blindness.

Case II. Mrs. Jul. Kahn, of this city, 21 years of age, consulted me, August 22, 1872. She had had good eyes until fourteen months previously, when one day during her seventh month of pregnancy, while she was sewing, her left eye suddenly, without pain or irritation, became blind. At the time of this accident, as well as for a short interval before and after it, she frequently suffered from palpitation, headache, dizziness, and was easily excited. Her sight improved steadily the first month after the sudden attack of blindness, but since that time it has remained stationary in the condition in which it still is.

Status præsens. The upper half of the visual field of the left eye is completely absent. S=$\frac{20}{40}$. The lower half of the optic disc is intensely white, the upper half somewhat whiter than usual and the disc of the other, perfectly normal, eye, yet differing distinctly from the lower half by a marked admixture of red. The inferior branches of the central retinal artery are very thin, and bordered with white stripes. The calibre of the upper retinal arteries is also a little smaller than in the other eye, but a great deal larger than that of the lower arteries. The veins are of normal thickness throughout. The appearance of the background of the eye, apart from the optic disc and arteries, presented nothing unusual.

Case III. Mrs. Dietr. Hornholtz, of New York, 37 years old, consulted me, March 29, 1872. She stated that six years previously she had felt ill, feverish, chilly, and weak. She had suffered from headache and palpitations, but not from articular rheumatism. In this state of health, when she was sewing one afternoon, both her eyes became suddenly obscured, and she experienced intense headache. In the

course of a few minutes her left eye cleared up, but the right remained dark much longer, improving gradually in a few weeks to the condition in which it has continued ever since.

Status præsens:—No outward changes visible. Sounds and size of heart normal. S=$\frac{20}{200}$ in the right, =$\frac{20}{40}$ in the left eye. A sector of the visual field of the left eye, comprising its inner and upper third, was absent. It was bounded inwardly by the horizontal meridian, and upwards by a line passing from the point of fixation diagonally across the upper and outer quadrant. A full quarter—the lower-outer—of the optic disc was white and punctate, the remainder reddish, as usual (Fig. 7, Tab. C). One arterial trunk, the lower and outer, was exceedingly thin, and bordered on both sides by a white line extending about 1 P (diameter of papilla) beyond the limit of the optic disc. No other abnormity was seen in this, and none at all in the other eye.

The CHARACTERISTIC FEATURES in all these cases are:

1. *Sudden appearance* of the *impairment of sight*, which at first manifests itself as an obscuration of the whole visual field of the affected eye, but more or less rapidly disappears in one part, leaving a defect in the upper or lower half.

2. When a primary branch of the central retinal artery is obstructed, it results in *superior* or *inferior hemiopia;* but when a secondary branch only is obstructed, a *sector-like* defect in the upper or lower half of the visual field is observed. At least one border-line of both the hemiopic and sector-like defects coincides with the horizontal meridian.

3. The portion of the optic papilla lying in the opposite direction to the defect in the visual field, becomes white and punctate—*partial atrophy of the optic nerve*—which is well set off by the remainder of the papilla retaining its usual appearance unchanged.

4. The obstructed arteries become *thin, seamed with white streaks, and disappear a short distance from the papilla.* The veins are not changed.

I do not know what other diagnosis than that of an embolism of branches of the central retinal artery could be derived from this series of symptoms. The cases of sudden impairment of sight and sector-like defects in the visual field which I have described, and explained by embolism of a ciliary artery (Graefe's Archives, xiv. 1, p. 237, etc., 1868), differ from those under consideration, in that the affection is only temporary, and connected with hyperæmia and œdema, instead of anæmia and atrophy of the retina. I do not doubt that many observations of superior or inferior hemiopia, for which no cause was found, were cases of embolism of a branch of the central retinal artery, and will in future be ascribed to it. All the symptoms above mentioned may not in every case be pronounced, but a part of them will render the diagnosis more or less probable. I recollect having seen cases of superior or inferior hemiopia in which only the opposite half of the disc was atrophic, but the arteries moderately well filled. This does not exclude embolism of a retinal arterial branch, as we see the same condition in embolism of the whole central retinal artery. It shows that a communication of the retinal with a collateral artery has been established.

CASE OF EPITHELIOMA OF THE CHEEK AND LOWER EYELID—REMOVAL —BLEPHAROPLASTY.

DR. J. H. POOLEY,

Surgeon to the St. John's Riverside Hospital, Yonkers, N. Y.

WILLIAM RAFFERTY, aged thirty-seven, born in Ireland, occupation laborer, married, had six children: two are dead, four living. His father and mother are dead; neither they nor any other of his relatives ever had any disease similar to his own. His right eye is sightless and wasted (Phthisis bulbi), from an inflammation which destroyed it in early life, the result of an attack of small-pox, which has left abundant traces of its ravages upon his face, which is badly pitted, particularly on the forehead.

His health is not good: he has had cough with severe dyspnœa and palpitation for several years. Upon making a physical examination of his chest, a very marked and loud cardiac murmur was found to exist, mitral regurgitant in character, with hypertrophy and excessive action of the heart. It was thought by one physician who examined him that he had also an aortic murmur, but I could not detect it.

His appetite and strength are fair, and when he does not exert or hurry himself, his heart disease does not trouble him very much; but anything like haste or excitement makes the dyspnœa intolerable. Up to this time he has had no dropsical symptoms. He is of a dull, phlegmatic temperament, and not over-intelligent.

Four years ago he was working in a brick-yard, and his face frequently became covered with sand and sweat, which he was in the habit of rubbing off with the sleeve of his red flannel shirt, particularly around the lower lid and corner of his left eye, where it was most troublesome. To the irritation thus produced he attributes a small sore, which made its appearance at that time upon the lower eyelid.

This, when it first attracted his attention, was not much larger than a large pin's head, and has been steadily increasing in size ever since. It has been treated from time to time with various salves and caustics; but without any effect, except perhaps that of stimulating and hastening its growth. At present there is a large oval-shaped epithelial growth occupying the whole of the lower eyelid, and the upper part of the cheek; it extends beyond both the internal and the external canthi; is three inches in length, and one and a half in width. It projects considerably from the surface, and its irregular fungating summit is curled over the base somewhat after the fashion of a mushroom. It

Fig. 1.

is covered with a black adhesive crust, probably the result of nitrate o silver which he has been applying to it, and discharges a watery fluid, which is sometimes offensive. It has never been very painful, but is the seat of a constant burning sensation, and occasionally of a troublesome itching. The cervical and sub-maxillary glands are not enlarged. The appearance of the growth is seen in Figure 1, taken from a photograph.

Rafferty was admitted into the St. John's Riverside Hospital, April

24th, 1871, for the purpose of having the growth removed by operation. The operation was performed on the 27th, three days after his admission, and, owing to the fears entertained by some present of its effect upon his diseased heart, without an anæsthetic, although I did not myself share in these apprehensions. The morbid growth was freely removed, even to portions of it extending slightly within the orbit. This was not done by any previously planned incisions, but by circumscribing it with the knife, and following it up where any suspicious-looking tissue was discovered.

The large gap or cavity thus formed, and which at first looked quite formidable, was then restored by flaps modelled after its size and shape, and derived from the nose and forehead.

Fig. 2.

An incision was carried down from the inner canthus (Fig. 1) along the outer border of the ala nasi nearly to the tip of the nose, then across to a point just beyond the middle line or bridge of the nose, then upward parallel to the bridge to a point one inch from the point of starting.

The flap thus dissected up was triangular in shape, its truncated sum-

mit forming the pedicle. It is seen at *a*, Fig. 2; its length was one inch and seven-eighths; its breadth one inch and a half; the breadth of its pedicle one inch.

In forming this flap, one of the vertical incisions was made just beyond the bridge of the nose rather than exactly in the middle line, not to gain more flap, but to make the subsequent scar less unsightly. The flap fell easily into its place, without traction or constriction of the pedicle, and, as is seen by referring to the diagram, Fig. 2, formed more than one-half of the new eyelid. The remainder of the eyelid and the wound on the cheek were filled up by a flap taken from the forehead, irregularly elliptical in form and of large size. This is marked "*b*" in the diagram; it was four and a half inches in length, one and three quarters in width at its widest part, and, like the other, had a pedicle one inch in width. In adjusting it, the pedicle, which might with advantage have been wider, but could not, was more twisted than the other, still it came easily into place, and without any undue constriction an arterial branch could be felt pulsating in it; the skin of which it was composed was fairly peppered with small-pox pits or scars, but in dissecting it off I did not notice any deep change in structure or any firmer adherence to parts beneath than in the other flap.

These flaps filled up the deficiency with great exactness, and after waiting a few minutes for the bleeding, which was slight, to subside, were carefully and minutely adjusted with points of interrupted suture, forty-eight in number, for which purpose black silk was used; there was not the slightest strain anywhere. I consider the use of *black* silk for sutures in these operations, which I learned from Professor Knapp, as a decided practical improvement, and as this is a department of surgery where attention to minutiæ is preëminently important, I take the liberty of calling the attention of operators to the point. The dressing applied was simply a perforated oiled piece of linen and picked lint.

The patient bore this operation, which was necessarily a protracted and painful one, with perfect fortitude, only interrupting us once in the middle of the proceeding to ask for a drink of whiskey, which eminently reasonable request was of course granted. His pulse was not affected, nor the action of the heart hurried, during the three hours he was on the table.

The growth, after its removal, was examined by Dr. S. G. Perry, of this place, an accomplished microscopist, and found to possess all the characteristics of epithelial cancer.

In two days the flap from the forehead began to show evidences of deficient vitality, and in a week had nearly all sloughed away except the pedicle; but that from the nose, constituting most of the lower lid, did well, and by the process of cicatrization and contraction the result was very admirable, almost as good as I had anticipated if both flaps had lived. May 15th he was discharged from the hospital, with

Fig. 3.

the wound nearly healed. October 2d I saw him; there has been some contraction of the scar, and the lower lid is dragged slightly down, preventing complete closure of the eye, but he suffers no inconvenience therefrom, and there is no lachrymation. Fig. 3, from a drawing taken October 11th, shows his condition at that time. It was my intention to have had a photograph taken for this purpose, but his heart-disease became so much worse that he could not walk to the photographer's; but the drawing is an accurate representation of his appearance.

From the latter part of November the heart-disease confined him entirely to the house; for many nights he was unable to lie down at all, and could only snatch a few minutes of sleep while sitting in a chair. His legs, face, and upper extremities began to swell; in particular, his left arm and hand were very much distended and of a purple color; he had troublesome expectoration of frothy, watery material, and almost complete failure of appetite. During his paroxysms of dyspnœa it was curious to see the deep purple color of the cicatrices contrasted with the general pallor of his countenance.

There are many points of interest in this case; it suggests the inquiry whether the presence of heart-disease, even when strongly marked, is necessarily a contraindication to the administration of an anæsthetic. I believe it is not. I have searched all the authorities at my disposal on this point, but do not find anything very definite on the subject. Without citing any of them, however, I may say that most of those who take notice of it at all agree with the opinion I have expressed. If an anæsthetic is administered in such a case, which should it be, chloroform or ether? I answer, chloroform, for the following reasons: it is more quickly administered and more manageable; it requires less of it to be given; it produces a less violent and protracted stage of excitement. I have seen chloroform administered for the dyspnœa of heart-disease both by the stomach and by inhalation with decided benefit and without the least bad effect.

With regard to the sloughing of the forehead flap, we may enumerate at least three circumstances to account for it: the large size of the flap, and, perhaps, the disproportionately small size of its pedicle; the

heart-disease affecting circulation and nutrition in all parts of the system; and, the character of the integument used, it being pitted with small-pox. In my own mind I am inclined to give the predominance to the latter condition. Small-pox pits are undoubtedly examples of true scar-tissue, a tissue which is proverbially of low vitality, and therefore unfit for plastic operations, which demand the highest vitality in the tissue employed in making flaps, and demand the observance of every auxiliary to preserve that vitality and defend it from adverse influences.

Flaps of transplanted skin often slough in the best of circumstances, and with all the difficulties presented in this case, it can be no wonder that what must be considered relatively a very large one should have done so.

Furthermore, we learn from this case how much nature alone can do to remedy what appears at first and to short-sighted observation an irreparable loss in such a case; so great, indeed, is this, that it has led some men of good judgment and large experience to express a doubt whether it would not be safe and justifiable in the removal of such growths to trust the case to the granulating and cicatrizing process entirely, and not attempt any plastic operation at all. With such opinions I cannot agree, particularly where the tissue of the eyelids is involved. Here the nice art of the plastic surgeon can do and has done wondrous things.

As there can be no rules laid down in this department of surgery which will be a sufficient guide for every case, therefore the records of cases themselves will always furnish the best hints from which operators

may adopt that which is suitable to their necessities; and as Professor Knapp has laid us under great obligations by the record of several very remarkable and ingenious operations of this sort in these "Archives," I judged this to be the best possible place for the publication of the present case.

After some weeks of severe suffering, poor Rafferty died, December 22d, 1871. His wife refused to allow a post-mortem examination to be made.

EPICANTHUS AND ITS TREATMENT.

By H. KNAPP.

Since F. A. Von Ammon first gave the name of *epicanthus*, and described (Zeitschrift für Ophthalmologie, Vol. I., page 533, etc., 1831) the peculiar redundance of skin which, in the shape of a semilunar fold, stretches from above downward in the region of the lachrymal sac, so as to cover, more or less, the inner canthus and caruncle, this affection has been generally admitted into the classification of eye diseases. The literature on the subject, however, has remained remarkably scant; and if we consult the leading text-books of ophthalmology, we find so little information in regard to its proper mode of treatment that the publication of new experience can scarcely fail to be welcome.

It is a fact that the congenital deformity known under the name of epicanthus generally diminishes with advancing years. Most oculists, therefore, are unwilling to operate for it on children, or to interfere with it at all. Having seen, however, cases in adults where the deformity was still very conspicuous, I have made it a rule to remove the anomaly in all instances in which its degree is so marked as to cause notable disfigurement. I think operative interference is especially indicated when epicanthus is complicated with ptosis and squint. Children thus affected have not only a very unnatural expression of countenance, but acquire a habit of looking

with one eye only, keeping the other shut, and holding the head backward toward the side of the closed eye.

The *operations* advised for epicanthus are *twofold: first, to attack the redundant fold of skin itself; and, secondly, to excise a piece of skin from the back of the nose*—Rhinorrhaphy.

I have performed, at Heidelberg and in New York, a considerable number of operations for epicanthus, with varying results. It seemed to me at first that the incision or excision of the integumental fold was so natural and simple a procedure as to deserve trial. I incised the fold of skin horizontally at the level of the inner canthus, or excised a small wedge-shaped piece of it, and stitched the edges together in the manner practised in the operation for blepharo-phimosis, commonly called canthoplasty. The results looked favorable at first, but proved unsatisfactory on account of more or less extensive recurrences of the deformity.

In other cases I excised the fold of skin from above downward, and united the edges of the wound with sutures. The deformity was removed, but in a few weeks it began to re-establish itself. In some of these operations I had noticed that the redundant fold of skin was raised and supported by a dense aponeurotic subcutaneous cord of connective tissue. Thinking this cord to be the primary cause of the failure of many operations, on account of the relapses, I excised it clean to the periosteum, and united the wound by ordinary sutures, as before. By this method I now and then obtained a satisfactory result; but in the majority of cases the deformity reappeared, and in some instances

in a marked degree. This will not be very astonishing, if we remember that the contraction of cicatrices is always greatest in the direction of their longest diameter —a fact which throws, *a priori*, an unfavorable light upon all operations for epicanthus, in which a vertical fold of skin, with or without subcutaneous fibrous tissue, is removed. The other method, by excising a wedge-shaped piece from the centre of the epicanthus, fails also on account of the subsequent contraction of the scar. Analogous examples are the reunions of divided commissures, webbed fingers, etc. But let me not forget to mention that each one of the described operative procedures sometimes yielded a satisfactory result. As, however, the relapses were too frequent, I have of late not practised them.

It was only while arranging my material for this paper that I looked up the literature on the subject.

In a short article by M. J. A. Schön, of Hamburg, in Von Ammon's Zeitsch. f. Ophth., II., p. 120–122, 1832, I find a passage so much in accordance with my observations that I cannot refrain from transcribing it:—

Schön saw an operation for epicanthus performed, in 1823, by the elder Von Gräfe. The operator raised a fold of the epicanthus with a pair of forceps, and excised with scissors a triangular piece of it, and cut deeply into the underlying tissue toward the bone of the nose, near the inner canthus, to the extent of about one line. The wound was covered with a small dossil of lint, besmeared with cerate. Schön says that he described this procedure from memory, and could not vouch for its accuracy, nor did he see the result of the operation; but mentions that V. Gräfe, Sen., stated to have successfully operated several times according to this method. Nearly the same operation, only less extensively, was performed by Von Ammon on a boy. He

only divided the fold of skin with a knife, and tried to prevent reunion by filling the wound with fine lint, but was unsuccessful in the attempt. Then he made a longitudinal incision through the transverse section, pared the flaps from their summits to their base, removing so much of them as to produce a regular quadrangular defect in the skin. But in two weeks the integumental fold was re-established. Now he performed, with the most brilliant result, an operation invented by him, and styled "*rhinorrhaphy*," consisting in the excision of an oval piece of skin, more than an inch in length, from the root of the nose.

Schön concludes by stating that this operation seems to him greatly superior to that of Von Gräfe, Sen.

I have repeatedly performed Von Ammon's rhinorrhaphy. The epicanthus was always cured, but, in the majority of cases, not without an ugly scar on the nose. In some cases the cause of the scar was carelessness in the after-treatment, the children hurting themselves on hard objects, by which the wounds disunited. In others the middle sutures gave way without any apparent imprudence. It seemed to me that the aponeurotic condition of the subcutaneous tissue in these cases produced too great a traction on the wound. I have always employed the ordinary suture, with China bead silk, never the twisted suture with hare-lip pins.

Some months ago I operated on a typical case of epicanthus. As it presented all the features of this affection, and was a perfect success, I may be allowed to relate its history:

A little girl, C. A., of New York, was brought, when two years old, to the late Professor A. Von Gräfe, in Berlin. Though the parents had made the long journey, he positively refused to operate on the child, or do

anything for it at that time, believing that the deformity would disappear when the child had reached about her sixth year. Two years subsequently she was brought to me. There was complete ptosis of both eyes, a marked bilateral epicanthus, and divergent strabismus. The child had the habit of opening one eye only at a time, by forcibly raising the brow while the head was thrown back, and inclined to the opposite side. Half the pupil of one eye was thus uncovered. The child used both eyes alternately. The eyes themselves were healthy. The disfigurement was so great that I found it quite natural that the parents consulted "almost everybody." My advice was to have the ptosis and squint removed without delay, in order to give the child the chance of obtaining binocular vision; for which, I feel confident, there is a greater probability when the operation for strabismus is performed in early youth than later in life. As the parents told me that the epicanthus had not noticeably diminished, I advised them to have it also removed, but some time after the other operations, rather than have the necessary five operations done at the same time. The parents seemed to agree with my views, and concluded to have the child operated on in the manner I had proposed. But occasional sickness of the child and other disturbances in the family caused a delay of the operation for two years, during which time the child developed well; but the condition of her eyes underwent no change. When she was six years old, I operated on both upper eyelids for ptosis, and performed tenotomy of one external rectus muscle. The ptosis operation—excision of an oval piece of skin and

muscle, and uniting the wound by sutures—answered the purpose perfectly. The eyelids opened by contraction of the frontal muscle, over which the child had a great command, so as to uncover nearly the whole pupil without throwing her head back. Before the operation, the constant efforts to raise the upper lids had caused the eyebrows to assume a higher position than natural; and as the centre of each brow was higher than its ends, the brows had unpleasant angular curves. This circumstance, together with the increased space between the brow and the free edge of the upper lids, added to the strange appearance of the child's countenance. Both peculiarities were removed by the ptosis operation. The eyebrows came down, the notch in their centre disappeared, and the free edge of the upper lids, which before always showed a convex outline, now was nicely curved, with the concavity downward, when the child raised the lids. The closure of the palpebral fissure was complete and easy. The tenotomy of the external rectus of one eye had not removed the squint entirely. Furthermore, the child did not lose her habit to use both eyes alternately instead of simultaneously, and would frequently squint upward with the operated eye when the other was directed toward the object of fixation.

Four months ago, that is, nine months after the first operation, I performed a tenotomy of the other external rectus, which removed the slight degree of divergent squint left after the first operation. At the same time I performed rhinorrhaphy. A rhomboidal piece of skin on the root of the nose was circumscribed and excised. It was over an inch in length, and nearly two-thirds of an

inch in width at its broadest part. The skin of both sides was carefully undermined, in long strokes, with a very sharp knife. When the bleeding had subsided, the wound was united by eight ordinary sutures with fine China bead silk. I was scrupulously careful not to bruise the edges of the wound, and to unite them as perfectly as possible. The region of the wound was strapped with court-plaster, to relieve the stretching. No bandage was applied. The appearance of the wound and eyes looked satisfactory in the highest degree. The epicanthus had completely vanished. The child was watched unremittingly, day and night, lest by rubbing or a hurt the union of the wound be disturbed. Nothing of the kind happened. No inflammation set in. Four sutures were removed on the sixth day, and the other four on the eighth. The union *per primam* was perfect. That it had not been obtained without lateral stretching was visible during the following weeks by the condition of the newly-formed tissue between the edges of the wound. This tissue had a breadth of one line at its centre, where the traction had been greatest, and narrowed towards both ends. The elastic newly-formed tissue which was interposed between the edges of the wound, and united them, yielded to the traction in a certain degree, but did not rupture. The surface of this interposed tissue—the cicatrix—was perfectly smooth, and at the level of the surrounding skin. Its color was faintly redder. The scar was hardly perceptible.

The epicanthus did not return, the divergent strabismus was removed, but the child for some time showed a

tendency occasionally to squint upward with the eye first operated on. More and more, however, the simultaneous fixation with both eyes became predominant, and at this day it is almost fully established. The eyelids are easily raised, and the reclination of the head has also disappeared.

In this case, which presented about all the complications connected with epicanthus, a complete success of the different operations was obtained. Accuracy and neatness of performance, and great care during the after-treatment, seem to be essential to attain union by first intention in Von Ammon's rhinorrhaphy. Its originator used hare-lip needles to unite the wound. I prefer, in delicate plastic operations, the ordinary sutures, carefully tied and closely set.

After many trials, I purpose to abide by Von Ammon's method, with the modifications described in the foregoing case. SICHEL (*Annales d'oculistique*, t. xxix., p. 211) recommends to pass some threads under the raised skin on the back of the nose before excising the skin with scissors. L. WECKER—*Traité des Mal. des Yeux*, t. i., p. 621—fears that the operator in this case may be liable to sever one or several threads while excising the piece of skin. Wecker, therefore, recommends to pass threaded curved needles only half way through, under the raised fold of skin, excise the skin with scissors, then draw the needles completely through both flaps, and tie the threads. This method is simple, and may answer in low degrees of epicanthus; in higher degrees, however, I should not recommend it, fearing that union by first intention may not be ob-

tained. I must not omit to mention that for high degrees of epicanthus simple excision of an oblong piece of skin from the root of the nose, without applying any sutures at all, has been proposed, with a view that the more extensive contraction of the cicatrix after the healing by suppuration removes the epicanthus more efficiently. I cannot agree with this proposal, as the cicatrices I saw when primary union was not obtained were rather bad-looking.

To conclude with *summing up* the results of my experience, I may state as follows:—

Epicanthus of a higher degree, which does not diminish or disappear during the first four or five years of life, is not likely to do so later in life, and should be removed by operation.

The operative procedures which attack the integumental fold itself are apt to fail, as the subsequent cicatricial contraction frequently produces relapses.

Von Ammon's rhinorrhaphy—removal of a rhomboidal piece of skin from the root of the nose, and uniting the edges with sutures—is a reliable method for the removal of epicanthus.

We must endeavor to obtain union by first intention, on account of the disfiguring scars which are left on the back of the nose when suppuration ensues.

To obtain primary union, the excision of skin should be done carefully, the adjacent skin undermined without any bruising, and the wound well united by delicate and closely set sutures. Strapping with court-plaster may help to diminish the tension of the skin.

During the first days after the operation great care

is to be recommended, lest by restlessness of the patient, or some accident, a separation of the wound ensue, the consequence of which would be a bad-looking scar.

NEW YORK, *September 1st*, 1872.

CLINICAL CONTRIBUTIONS TO OPHTHALMOLOGY.

By Dr. LANDESBERG, of Elberfeld.

(Translated by Dr. E. Gruening.)

I. PERFORATING SCLERAL WOUND. COMPLETE RECOVERY.

The ophthalmological market is so abundantly supplied with cases of scleral injury, that in adding to the stock I fear to weary the patience of my colleagues. If, however, regardless of this reflection, I publish the following case, I appeal to its heading for an apology.

In our industrial valley of the Wupper, we have an ample opportunity of treating divers injuries of the eye, and observing their course. Unfortunately, in the vast majority of these cases our curative attempts prove futile. Even if we except neglected cases coming under our care after much delay, and exclusively consider perforating wounds, under immediate and skilled attendance, we obtain no better statistics. Vision remains more or less extinct, the globe begins to shrink, and we are glad if cyclitis does not supervene. Occasionally we are cheered by a favorable result, but even then have no certainty of its permanence. We discharge the patient with comparatively good sight, while the

lurking enemy is perhaps at work to destroy irretrievably the gain of a hard struggle.*

For this reason I think it justifiable to publish those cases in which, despite the severity of the injury, sight is not only recovered, but also permanently retained.

In the night of the first and second of November, 1868, E. B. was maliciously cut in the face with a sharp knife. Being summoned immediately after the infliction of the wound, I found the patient in a state of syncope from profuse hemorrhage. I then noted the following injuries:—

1. In the left upper lid an incised wound, 1½″ in length, running from above downward and inward, and cutting through the whole thickness of the lid.

2. In the eyeball a lacerated wound, beginning at the limbus conjunctivæ and extending backward. It measures 2‴ in width, and 3‴ to 4‴ in length, has jagged edges, and perforates all the coats of the

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* I beg leave to illustrate these remarks by two pertinent cases of my observation:—

I. On March 6, 1871, I was called to see a little boy, aged three years, who had wounded his left eye with a penknife. Examining the patient shortly after the occurrence of the accident, I found the eye in the following condition:—

Left eye. Incised scleral wound, beginning a little above the insertion of the inferior rectus, running in a straight line to the limbus conjunctivæ, and touching the lower periphery of the cornea. Iris prolapsed; anterior chamber filled with blood; whether the lens was intact I could not learn; eyeball very soft.

I snipped the prolapsed iris, instilled atropine, and applied a pressure bandage.

The wound healed without the slightest reaction. On April 4, I noted: Wound cicatrized; anterior chamber deep; cornea and other refractive media perfectly clear; fundus normal. After closing the right eye the patient walks about and recognizes the smallest objects.

I discharged the patient, but kept him under observation for several months, during which time I was greatly pleased with the favorable condition of the eye.

On December 11th, the patient was brought to me in the following state:—

Left eye. Ocular conjunctiva chemotic; anterior chamber very shallow; iris swollen and nodular; almost complete circular synechia; secondary cataract;

globe. The iris and vitreous body are wedged in the gap. No anterior chamber. Behind the cornea a mass of blood. Perception of light extinct. Ocular conjunctiva and lower lid very ecchymotic.

3. A wound extending obliquely from the inner angle of the eye along the left wing of the nose and the upper lip, cutting through the whole thickness of both, and causing a considerable gaping of the cleft parts.

The stab had been inflicted with great force from above downward, its lower limit being marked by a deep cut in the breast of the coat.

I fulfilled all the indications at once, applied a pressure bandage, and put the patient to bed.

The following day the reaction was very considerable. Conjunctiva greatly chemotic. Eyeball soft and tender. Scleral wound gaping. Vitreous oozing from the wound. On the whole, the eye bears the impress of incipient panophthalmitis.

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intraocular pressure increased; eyeball somewhat atrophic; perception of light extinct.

The present affection began about one week previously, without an assignable cause.

I used antiphlogistic means and succeeded in suppressing the inflammatory symptoms.

II. On October 17, 1871, I was summoned to see C. S., a little boy, aged two and a half years. I found the patient in the following condition :—

Right eye. Lacerated scleral wound, 6 mm. in length, beginning near the limbus conjunctivæ in the upper and outer quadrant, and running obliquely downward; prolapsus iridis; cataracta traumatica.

The little boy had been injured by falling and striking his face against a stone, three hours before I saw him.

The inflammatory reaction, though very considerable, was successfully combatted by an energetically antiphlogistic course of treatment. In the third week, with a view of guarding against the injurious swelling of the corticalis, I performed iridectomy. This proved a valuable auxiliary in accelerating absorption.

When all inflammatory symptoms had subsided, I discharged the patient—Dec. 9.

During the following three months I examined the patient from time to time, and was well pleased with the result.

The corticalis was completely absorbed; vitreous body intact; fundus normal; vision good.

About two weeks ago I noticed a diminution of sight. Examining the right eye with the ophthalmoscope, I found floating opacities in the vitreous and an incipient retinal detachment in the upper and inner quadrant.

The inflammatory symptoms were very severe until the eleventh day; from that day the eye improved slowly but steadily. The scleral wound remained gaping a long time, the iris and vitreous acting as a plug, and preventing a further prolapse. Gradually the intraocular pressure increased and the anterior chamber filled. The extravasated blood disappeared, and the lens was found intact. An intraocular hemorrhage had undoubtedly also taken place, as quantitative perception of light did not return over the whole extent of the field of vision until the third week.

The case progressed very favorably. After abscission of the prolapsed iris, the scleral wound closed with a firm cicatrix. The pupil, oval in shape, and drawn toward the nasal side, was perfectly movable and free from synechiæ. No trace of a deposit on the anterior capsule of the lens.

On January 13, 1869, I discharged the patient cured, and the examination showed :—

R. Hm $\frac{1}{8}$ S=$\frac{7}{20}$
L. Hm $\frac{1}{4}$ S=$\frac{6}{20}$

Reads Snellen II. with + 6 at 7″ with either eye.

L. Refractive media clear and transparent. Not the slightest trace of opacity in the vitreous. Scleral wound, firmly cicatrized. Shape and resistance of eyeball normal. Fundus and visual field intact.

I re-examined the patient twenty-one months after his discharge, and found the eye still in the same condition.

II. GLAUCOMA FULMINANS. RECOVERY WITH GOOD SIGHT AND COMPLETE FIELD OF VISION.

In the Archives of Ophthalmology, Vol. VIII., part II., Von Graefe published several cases of glaucoma fulminans, and reported his observations, as regards the influence of both early and delayed iridectomy upon the

recovery of sight. Subsequently this subject was almost completely dropped, and no pertinent cases appeared in our special literature. Yet I consider it both interesting and instructive to obtain further proofs *concerning the influence of iridectomy upon the restoration of sight, and the visual field in glaucoma fulminans*, and believe that this form of glaucoma, if accurately observed in its various stages, is best adapted to furnish us a key to many as yet unsolved problems. As an addition to Von Graefe's series of observations, I publish the following case:—

I was consulted by Mrs. L. A., aged 58 years, who had lost the sight of both eyes. On examination I found both eyes in the following condition:—Considerable chemosis of ocular conjunctiva. Eyeball exceedingly hard. Pupil moderately dilated, not sensitive to even the strongest light. Anterior chamber very shallow. Cornea hazy, its sensibility diminished. With oblique illumination both corneæ show opaque radiating stripes; these are very dense in the right cornea, and alternate with fleecy patches. Ciliary neurosis intense. Other symptoms of irritation very severe. *Right eye*, quantitative perception of light. *Left eye*, no perception of light. Ophthalmoscopic examination impossible.

The patient states that the prodromic symptoms appeared in the right eye six months ago, up to which time she had enjoyed good sight. In the spring of 1868, the right eye became slightly inflamed, and its sight temporarily obscured. Similar attacks, varying in duration and intensity, followed at irregular intervals. The patient ascribed these symptoms to her usual megrim, and consulted no physician. The last attack, on January 18, 1869, was exceedingly severe. Sight diminished rapidly, and on the next day, when I first saw the patient, was reduced to quantitative perception of light. On the morning of that day the left eye, which until then had remained intact, grew exceedingly painful, and its sight vanished so rapidly as to become extinct in the course of the forenoon.

Six hours later I performed iridectomy on the left eye, and the following day on the right.

In both eyes the wound healed but slowly, and symptoms of irritation of great intensity continued a long time. Intraocular pressure remained high, the wounds closed tardily, and in the right eye with a cystoid scar.

The final result, however, was excellent.

On February 22, the patient was discharged in the following condition:—

Tension normal in either eye. No trace of irritation. *Left eye:* cornea and the other refractive media perfectly clear. *Right eye:* cornea in its upper periphery studded with opaque specks. Aqueous humor and vitreous body clear. Anterior chamber restored.

In both eyes: Excavatio papillæ nervi optici.

$$\left.\begin{matrix}\text{R. S. } \frac{9}{20} \\ \text{L. S. } \frac{9}{3}\end{matrix}\right\} \quad \text{Hm } \frac{1}{16} \text{ either eye.}$$

With + 10 R. Jaeg. 7. L. Jaeg. 2.

R. Field of vision contracted in the upper and inner quadrant.

L. Field of vision complete.

Subsequently the sight of the right eye improved to $\frac{9}{7}$, but after some time grew considerably worse again.

On March 3, 1870, the examination showed: R. S. $\frac{1}{20}$, with + 10 Jaeg. 13. Intraocular pressure increased beyond the physiological range. Contraction of field of vision, as above.

The last examination, on June 16, 1871, showed: R. S. = Fingers at 15′. Tension decidedly increased. Incipient cataract.

No change in the condition of the left eye.

III. TWO CASES OF RIBBON-SHAPED CORNEAL OPACITY, COMPLICATED WITH INTRAOCULAR CHANGES.

In the Archives of Ophthalmology, Vol. xv., part III. Von Graefe first directed the attention of Ophthalmologists to a peculiar form of corneal opacity, frequently

coincident with glaucoma. He describes this affection most accurately, and terms it *Ribbon-shaped opacity of the cornea.* He states that in the course of this affection the uveal tract becomes involved. The participation of the inner coats of the eye manifests itself either as glaucoma simplex or as secondary glaucoma, with all its accompanying symptoms. Further observations and explanations of this peculiar and most interesting form of disease have, as far as I know, not yet appeared in ophthalmological literature.*

For this reason, I have no hesitation in publishing *two cases of ribbon-shaped Keratitis, associated with Glaucoma.* The first case is the choicest type illustrative of the pathogenesis of secondary glaucoma. The case is quite analogous to Von Graefe's cases, and (if we are allowed to draw conclusions from a single case) corroborates and at the same time modifies his views, as to the effect of iridectomy upon the further progress of the corneal affection. The second case is interesting from another point of view. It touches upon the question of hemorrhagic glaucoma, and the utility of iridectomy in this affection.

A. *Ribbon-shaped Keratitis, complicated with secondary Glaucoma.*

C. St., æt. 60, consulted me on November 24, 1868. The patient, a very intelligent and accurate observer, keeps a detailed account of

* Hirschberg describes a case of ribbon-shaped corneal opacity (Berl. Klin. Wochenschrift, p. 551), and explains it as sympathetic ophthalmia. Clarke describes three cases of symmetrical ribbon-shaped opacities. Neither mentions complications. (Vide Jahresbericht über die Leistungen und Fortschritte der Ophthalmologie. I. Jahrgang. p. 287.)

his affection, and knows the exact dates of its development. He states, that eighteen months ago he first noticed a diminution of the sight of his right eye. Naturally timid, he did not hesitate to seek medical advice at once. He received no local treatment. *Ut aliquid fiat*, blue protectors and a mild derivans were prescribed. In the meantime, the disease progressed slowly, but steadily. The sight grew worse and worse, and periodically symptoms of irritation and dazzling, attended with ciliary neurosis, appeared. When finally the left eye became implicated, the patient placed himself under my care.

I may frankly confess that I was greatly puzzled in diagnosticating the nature of a corneal affection of so strange an aspect. I could not recall an analogous case to guide me. Aside from other considerations, the whole appearance and shape of this opacity, which had attained its culminating point in the right eye and was developing in the left, led me to exclude a malignant neoplasm. Von Graefe's observations on this affection were published one year later, and so well did his description accord with what I had seen, that in perusing the masterly essay, I at once obtained a clear view of my own case.

The condition of my patient was as follows:

Right eye. Wide, ribbon-shaped, and continuous opacity corresponding to the palpebral fissure, and extending transversely over the whole cornea. The opacity is reddish-brown, and has an equal degree of color intensity from the margins to the centre of the cornea. The centre itself appears whitish-gray, as if a metallic salt had been precipitated there.* With oblique illumination, the epithelium seems to consist of minute dots of brown color. The ribbon-shaped opacity has a sharply-defined boundary line above and below. The upper and lower segments of the cornea are perfectly normal. Subconjunctival injection. Upon pressure with probe, right ciliary region more sensitive than left. Intolerance of oblique light. Tension normal. Sight greatly reduced. Patient counts fingers at the distance of 5′. With dilated pupil, sight $\frac{9}{40}$; with + 10 Snellen II$\frac{1}{2}$ at 10″. Iris reacts very sluggishly to atropine. After several instillations repeated at

* At first sight I asked the patient whether he had made use of a powder or a salve; this he denied.

intervals of ten minutes, the pupil dilates sufficiently to reach the clear parts of the cornea. Ophthalmoscopic examination impossible.

The left eye exhibits the first stage of the affection. Near the inner and outer margins of the cornea we find a narrow opaque stripe of a slightly brown shade. The opacity has the appearance of a thin stripe of brown color laid quite superficially on either side of the cornea with the most delicate touch of the brush. The centre of the cornea is perfectly transparent. Iris clearly visible. Reflection of the cornea normal. The opacity is best seen with oblique illumination. No symptoms of irritation. Mydriasis after instillation of atropine complete. Fundus normal. Hm $\frac{1}{30}$, S=$\frac{9}{10}$. With × 10 Snellen $1\frac{1}{2}$ at 6″.

In proposing to the patient to have an iridectomy performed on his right eye, I did not believe that this operation would influence the course of the peculiar corneal affection, but was guided by other considerations—viz., the great reduction of sight, the narrowness of the pupil, and the manifest hyperæmia of the iris. I wished to guard against a further participation of the iris, the formation of posterior synechiæ, and the supervention of the irido-chorioideitis. By the iridectomy I intended to better the sight and free the uveal tract from danger. I explained to the patient that the operation would most probably not stay the progress of the corneal affection.

The patient declined to be operated upon, and left me, saying he required time to consider the matter. On February 11, 1869, he presented himself again at my office. He had met with a sad disappointment. Under the care of a homeopathist, who had guaranteed a perfect cure, the pain had grown intolerable and the eye become blind. The fear of losing the other eye brought him back to me, with the determination to submit to whatever plan of treatment I should propose.

I found the right eye in the following condition: considerable degree of subconjunctival injection. Anterior chamber shallow. Eyeball very hard. Aqueous humor turbid. Several posterior synechiæ. Quantitative perception of light. Corneal opacity unchanged.

There were, in short, all the symptoms of secondary glaucoma.

The following day I performed a very broad iridectomy above, and injected morphia to combat the very violent ciliary neuralgia. One

day after the operation the tension of the eyeball had lessened. Recovery was tardy, owing to recurring inflammatory attacks and repeated hemorrhages into the anterior chamber. The final result was exceedingly favorable.

On April 23, when all the inflammatory symptoms had subsided, the patient was discharged. R. S=$\frac{6}{40}$. With + 10 Jaeg. 5.

The patient was re-examined on May 5. R. S=$\frac{10}{40}$. With + 10 Jaeg. 3.—L. S=$\frac{10}{12}$. Hm. $\frac{1}{24}$. With + 10, Jaeg. 1.

The eyes remained a long time in this satisfactory condition. In the right eye the inflammatory symptoms did not recur; in the left eye the disease did not advance, and the patient was able to resume and pursue his business. During the subsequent two years I kept the patient under observation, and noted the stability of his condition. One year later, when I was preparing this paper for publication, I looked the patient up. On the whole, he was satisfied with his condition, but complained that his right eye had of late become somewhat irritable. The annoyance resulting therefrom was but slight, and did not materially interfere with the proper discharge of his ordinary duties.

On examination I found the following:—In the left eye the disease had but slightly advanced. The opacity, though somewhat more intense than formerly, does not yet reach the centre of the cornea. Reaction of pupil perfectly normal. Iris clearly visible. Tension of eyeball normal. No irritability of the eye.

Right eye. Considerable advance of the corneal affection. The opacity has gained in width, upward and downward, leaving on either side a very narrow rim of clear corneal tissue. The aspect of the case corresponds to Von Graefe's, Fig. 3, Tab. 1, differing from the latter only as regards the extension upward. The opacity has a tendinous appearance, and is studded, especially near the inner and outer corneal margins, with fleecy spots. Tension normal. No irritability.

I had no opportunity of testing the sight accurately. With the right eye the patient read moderately large print.

b. *Ribbon-shaped Keratitis complicated with Hemorrhagic Glaucoma.*

S. D., æt. 55, strongly built and healthy-looking, consulted me on May 5, 1870, on account of an affection of his right eye. I noted the

following condition:—The right eye exhibits all the phenomena of subacute glaucoma. Increase of tension. Slight subconjunctival injection. Pupil moderately dilated, its reflex and consensual reactions sluggish. Anterior chamber shallow. Aqueous humor clear. Vitreous somewhat turbid. Fundus clearly discernible, with all its details. Excavatio papillæ nervi optici. Veins strongly injected and tortuous. Arterial pulsation easily produced by slight digital pressure upon the eyeball. *Peripherally above* (inverted image) *numerous hemorrhagic spots in retina.* Isolated patches of blood in the inner quadrant of the retina, and in the vicinity and on the inner side of the disc. Region of macula lutea perfectly free.

The cornea exhibits the characteristic appearance of that stage of ribbon-shaped keratitis in which the two legs of the opacity have not yet reached the corneal centre, and therefore form no continuous stripe. The opacity is brownish in color; corneal epithelium smooth and shining. With oblique illumination the brownish coloration seems to consist of minute granules. Iris normal in color and clearly visible; eye highly myopic in structure, with the correcting concave glass $\frac{1}{6}$ S=$\frac{5}{30}$. The patient reads Jaeg. 10 with great difficulty and frequent intermissions. He says the letters dance before his eyes, sometimes appearing dim and blurred, at other times clear and distinct. The examination of the visual acuity is very trying to the patient. Field of vision, superficially examined, seems equally contracted on all sides excepting the lower and outer quadrant.

Left eye. M. $\frac{1}{8}$ S=$\frac{8}{1}$; fundus normal; cornea shows no trace of incipient ribbon-shaped keratitis.

The patient states that, though myopic, his eyes had always served him in very trying work, and never troubled him up to two years ago. At that time he noticed that the right eye became more easily fatigued than the left. It seemed to him that a slight fog was veiling the sight of the right eye. At first he attached little importance to this observation; but when, in the course of time, the sight continued to grow worse, and symptoms of dazzling appeared, he sought medical advice without obtaining relief. In January, 1870, ciliary neuralgia and slight obscurations of the visual field supervened. These symptoms lasted but a short time and disappeared spontaneously. The attacks recurred at

irregular intervals and with variable duration of the attending phenomena of irritation. At the time when the first attack appeared the patient was at sea, and therefore unable to consult a competent physician. The case was thus protracted until May 4, when a violent attack of ciliary neuralgia, attended with obscuration of the field of vision, supervened. The attack passed away, leaving the sight considerably impaired. The patient then sought my advice.

The next day I performed a broad iridectomy above.

The wound healed nicely within a few days. The inflammatory symptoms abated rapidly. One day after the operation the tension of the globe was normal and remained so; the anterior chamber was restored; the opacities of the vitreous disappeared; the hemorrhagic patches were gradually absorbed.

On May 26, R. M. $\frac{1}{6}$; S $=\frac{5}{20}$; Jaeg. 4, and some words of Jaeg. 3; aqueous humor, lens, and vitreous clear; optic disk pale, slightly excavated; veins and arteries normal; several hemorrhagic patches completely absorbed; the visual field is considerably contracted on the inner side.

I re-examined the patient on June 29, and obtained the same result. He pursues his ordinary business and is well satisfied with the condition of his eyes. With concave glass, $\frac{1}{10}$ for either eye, he works with ease.

The last examination I made on July 22, 1871:—

L., M. $\frac{1}{6}$; S$=\frac{5}{8}$; Jaeg. 1.
R., M. $\frac{1}{6}$; S$=\frac{5}{20}$; Jaeg. 3, fluently.

Tension of eyeball normal; ribbon-shaped opacity has not gained; excavation of disc very shallow; hemorrhagic patches in retina absorbed; here and there along the course of the vessels masses of pigment.

The eyes remained in a very satisfactory condition in spite of a persistent strain. The limitation of the visual field has somewhat diminished.

CLINICAL OBSERVATIONS.

By CHARLES J. KIPP, M.D.,

OF NEWARK, N. J.

I.—A CASE OF PERSISTENT HYALOID ARTERY IN BOTH EYES.

F. C., 60 years of age, came under my care on account of a small splinter of wood embedded in the ocular conjunctiva of the right eye. As the patient at the same time complained of impairment of sight, an ophthalmoscopic examination was made, which, in addition to some atrophy in the choroid of both eyes, revealed the following anomaly: In the right eye a dark thin cord, surrounded by a grayish translucent envelope, was seen to extend from the optic papilla straight forward as far as the centre of the vitreous. Its diameter was that of a primary branch of the central retinal vein. The anterior end of this cord was about three times as broad as its trunk, somewhat flattened laterally, and divided into three short branches, the free extremities of which were bulbous. Its other end formed immediately before the centre of the optic disc a small loop and then disappeared. The loop was of a light red color, whilst the straight portion appeared dark. *Pressure on the globe produced pulsation in the loop as well as in the retinal arteries.*

In the left eye an artery of about the diameter of a primary branch of the central retinal artery was seen to extend from the centre of the papilla to about the middle of the vitreous body in a slightly outward and upward direction, when it formed a loop, and then, winding itself in a double turn around its first portion, returned to the papilla, where it disappeared. It was of the same diameter throughout, of a light red color, and in fact presented all the characteristics of a retinal artery. Pulsation was likewise visible in it when pressure was exerted on the eyeball.

On looking over the literature of the subject, I find that only eight cases of persistent hyaloid artery have been put on record, but in

none the anomaly was observed in both eyes, as in the case above described.

II.—SYPHILITIC IRITIS WITH GELATINOUS EXUDATION.

C. G., 23 years of age, contracted a sore on his glans penis thirteen months before he consulted me with reference to his iritis. According to his statement, this sore healed rapidly under treatment. No enlargement of the inguinal glands was noticed at the time, and his health continued good till about nine months later, when he contracted what he called a gonorrhœa. For this he was treated by injection, which caused it speedily to disappear. About three months later, a copper-colored eruption made its appearance on face and body, and scabs were noticed in his hair. As his throat also became very sore, he consulted a physician, who pronounced his disease syphilis, and treated him accordingly. I first saw this patient about four months after the discharge from the urethra had made its appearance; the eruption was at that time still present on the forehead. Mucous patches were seen on the mucous membrane of mouth, and the inguinal glands were slightly enlarged.

On examining the eyes, the left was found to be normal. In the right eye was noticed slight peri-corneal injection. The pupil was irregularly contracted. The iris was slightly swollen throughout, and near the pupillary edge of its upper segment was seen a slightly prominent point, the color of which was, however, the same as the rest of the iris. The aqueous was perfectly clear. Leeches to the temple, instillation of atropine, and inunction of ungt. hydrarg. were at once ordered.

On the following day the pupil was slightly more dilated, except in its upper portion. The prominent point above mentioned presented more the usual appearance of a gummy tubercle of the iris. Next day a grayish translucent exudation was seen to cover the condyloma, and to extend somewhat downward. During the next two days the exudation rapidly increased in quantity, so that on the fifth day it filled the entire anterior chamber with the exception of its periphery, thus leaving a very narrow rim of the iris still visible. The exuded mass was of a grayish color, was semi-transparent, and so coherent that no part of it, even while the

absorption was going on, sank to the bottom of the chamber. In form it so closely resembled a lenticular disc, with a sharply defined edge, that it could readily have been mistaken for a dislocated lens in the anterior chamber. After remaining in this condition for two days, the disc gradually diminished in size, and on the sixteenth day after the first appearance of the gummy tubercle, the exudation had completely disappeared. The pupil was now perfectly black, nearly circular, and well dilated; the condyloma had been absorbed, and its site was indicated only by a yellowish discoloration of the iris, and a firm posterior synechia. Frequent instillation of a solution of sulphate of atropine, and inunction of ungt. hydrarg., until tenderness of gums was developed, constituted the treatment.

The points of interest in this case are: 1, the primary lesion; 2, the peculiar exudation.

With regard to the first, there can, I think, be no doubt that the ulcer contracted first was a simple soft chancre, and that the gonorrhœa contracted nine months later was caused by a hard chancre in the urethra. The fact that secondary symptoms rarely appear later than six months after the primary lesion, and generally within three months after infection, taken in consideration with the history of this case, leave, I presume, but little room for doubt as to the correctness of this assumption.

Exudations of the above described character are probably not very infrequently seen in cases of iritis, as I myself remember having observed a similar exudation in a case of traumatic iritis, which at the first glance made me suppose that I was dealing with a dislocated lens. But as its occurrence in syphilitic iritis has, so far as I know, only been mentioned by Gunning, I have thought it worth while to bring it to the notice of the

profession. From close and frequent observation, I am quite certain that the exudation took place from the tubercle, for there it first made its appearance, and from there it spread in all directions, the whole being apparently one coherent mass.

REPORT ON SIXTY-FOUR CATARACT EXTRACTIONS ACCORDING TO THE METHOD OF VON GRAEFE,

*Performed at the Massachusetts Charitable Eye and Ear Infirmary, Boston, in the Year 1872, by the Surgeons of the Infirmary.**

COMPILED BY

DR. HASKET DERBY, BOSTON.

THE amount of vision obtained has been, as far as possible, recorded. But it must be remembered that many of our patients come from a great distance, and are not in possession of the means to enable them to make a second visit to the city. The vision stated in the table is, therefore, in many cases that ascertained at the period of discharge, and may reasonably be supposed to have subsequently improved.

All our patients belong to the poorer classes, many of them being in an extremely destitute condition, and enabled to visit the Infirmary only by the charity of friends. It would be unfair, therefore, to institute a comparison between our figures and those of ophthalmic hospitals which contain private rooms designed to be occupied by the wealthy, whose superior health and greater powers of endurance are well known to furnish more favorable operative statistics. Could the surgeons of the Infirmary have included in this table the results of their private practice during the past twelve months, the percentage of success would doubtless have been materially increased.

* Drs. Gustavus Hay, Hasket Derby, Henry L. Shaw, Francis P. Sprague, B. Joy Jeffries, Robert Willard.

ANALYSIS OF CASES OF CATARACT OPERATED UPON BY THE METHOD OF VON GRAEFE.

No.	Sex.	Age	Date.	Operation.	Remarks.	Duration of Treatment.	Result.
1	male.	85	Oct. 12, '71.		Much inflammation, causing closure of pupil. Iridectomy five months later.	19 days.	v = $\frac{5}{100}$.
2	male.	80	Oct. 10, '71.	Normal.	Irido-choroiditis one week later.	21 days.	counts fingers.
3	male.	36	Oct. 20, '71.	Normal.	Did extremely well until the patient went out, contrary to orders. Severe inflammation and bleeding into anterior chamber ensued with immediate loss of vision.	24 days.	v = 0.
4	male.	40	Oct. 24, '71.	Normal.		21 days.	v = $\frac{20}{40}$.
5	female.	50	Oct. 31, '71.	Normal.		17 days.	v = $\frac{20}{60}$.
6	female.	50	Nov. 6, '71.	Normal.		18 days.	v = $\frac{20}{60}$.
7	male.	45	Nov. 3, '71.	Normal.	Did well till fourth day, when he left his bed and the ward, contrary to orders. Irido-choroiditis ensued.	27 days.	
8	male.	21	Nov. 13, '71.	Normal.		19 days.	v = $\frac{12}{40}$.

No.	Sex.	Age.	Date.	Operation.	Remarks.	Duration of Treatment.	Result.
9	male.	65	Nov. 23, '71.	Normal.		28 days.	v = $\frac{3}{4}$.
10	male.	61	Dec. 4, '71.	Normal.	Some opaque capsule remained in pupil.	16 days.	v = $\frac{10}{80}$.
11	female.	62	Dec. 11, '71.	Normal.		31 days.	v = $\frac{10}{80}$.
12	male.	54	Dec. 7, '71.	Normal.	Hemorrhage into anterior chamber in consequence of blow on eye.	30 days.	v = $\frac{20}{100}$.
13	female.	68	Dec. 8, '71.		Patient very restless, wound remained open several days.	29 days.	v = $\frac{5}{40}$.
14	male.	71	Dec. 14, '71.	Normal.	Patient did well till an attack of pyæmia supervened, which proved fatal.		
15	male.	22	Dec. 29, '71.	Normal.	Extensive sclerotico-choroiditis.	26 days.	
16	male.	41	Dec. 30, '71.	Normal.		18 days.	v = $\frac{10}{30}$.
17	male.	58	Jan. 2, '72.	Normal.	Some cortical substance remained in pupil.	17 days.	v = $\frac{10}{80}$.
18	female.	63	Jan. 4, '72.	Some vitreous lost.	Lens cretaceous and dislocated, much pain and inflammation ensued.	55 days.	v = 0.

19	male.	66	Jan. 5, '72.	Normal.		28 days.	v = $\frac{30}{60}$.
20	male.	63	Jan. 5, '72.	Normal.		4 days.	v = $\frac{15}{60}$.
21	female.	43	Jan. 11, '72.	Normal.	Some opaque capsule remained.	9 days.	Unrecorded.
22	male.	77	Jan. 11, '72.	Normal.		14 days.	v = $\frac{10}{60}$.
23	female.	63	Jan. 25, '72.	Normal.		26 days.	v = $\frac{10}{40}$.
24	male.	50	Feb. 1, '72.	Scoop used.	Capsule in pupil.	26 days.	v = $\frac{15}{60}$.
25	male.	63	Feb. 2, '72.	Normal.		18 days.	v = $\frac{20}{60}$.
26	male.	24	Feb. 13, '72.	Normal.	Much capsule in pupil; secondary operation June 3.	11 days.	v = $\frac{20}{30}$.
27	male.	52	Feb. 15, '72.	Normal.		15 days.	v = $\frac{20}{40}$.
28	male.	30	Feb. 26, '72.		Traumatic cataract, vision 19 days after operation $\frac{10}{60}$. Fundus subsequently became obscured through vitreous opacities which suddenly developed.	20 days.	
29	male.	24	Feb. 29, '72.		Traumatic cataract.	25 days.	v = $\frac{10}{60}$.

No.	Sex.	Age.	Date.	Operation.	Remarks.	Duration of Treatment.	Result.
30	male.	60	Mar. 16, '72.	Normal.		20 days.	$v = \frac{15}{100}$.
31	male.	60	Apr. 2, '72.	Normal.		15 days.	$v = \frac{10}{100}$.
32	male.	42	Mar. 15, '72.	Normal.		11 days.	$v = \frac{10}{60}$.
33	male.	79	Mar. 18, '72.	Normal.	Patient reads Snellen 1 with + $2\frac{1}{2}$.	23 days.	$v = \frac{1}{10}$.
34	male.	70	Mar. 20, '72.	Normal.	Severe attack of colic the night after operation. Suppuration of cornea ensued.	28 days.	$v = 0$.
35	male.	68	Mar. 22, '72.	Normal.	The iris was cut with the knife and folded in, so it was grasped with the forceps. Wound healed a little slowly. Patient reads Snellen 1 at 4 inches with + $2\frac{1}{2}$.	30 days.	$v = \frac{10}{40}$.
36	male.	62	Mar. 29, '72.	Normal.		25 days.	$v = \frac{1}{2}$.
37	male.	80	Mar. 29, '72.	Normal.		28 days.	$v = \frac{1}{2}$.
38	female.	43	Apr. 2, '72.	Normal.	Cataract followed a blow on temple received two years before. It was found to be soft.	16 days.	$v = \frac{20}{40}$.

39	male.	20	Apr. 4, '72.		Cataract consequent on an explosion of gunpowder, and preceded by iritis. Projection upwards deficient.	22 days.	
40	female.	53	Apr. 9, '72.	Normal.		32 days.	v = $\frac{20}{80}$.
41	male.	71	Apr. 12, '72.	Normal.	Patient reads Snellen 1 with +2½.	19 days.	v = $\frac{1}{7}$.
42	female.	64	Apr. 20, '72.	Normal.	A posterior polar cataract in a patient very feeble.	21 days.	v = $\frac{10}{100}$.
43	male.	55	Apr. 24, '72.		Cataract traumatic, preceded by iritis; and at time of operation partially absorbed.	23 days.	v = $\frac{8}{100}$.
44	female.	16	Apr. 27, '72.			16 days.	Unrecorded.
45	female.	62	May 3, '72.	Normal.		8 days.	v = $\frac{20}{40}$.
46	female.	72	May 2, '72.	Normal.	Iritis supervened, subsequently trachoma, necessitating long after-treatment. Patient reads Snellen 4½ with +2.	64 days.	v = $\frac{15}{60}$.
47	female.	50	May 3, '72.	Normal.		22 days.	v = $\frac{20}{20}$.
48	female.	64	May 8, '72.	Normal.	Projection inwards, before operation, uncertain.	19 days.	v = $\frac{20}{60}$.

No.	Sex.	Age.	Date.	Operation.	Remarks.	Duration of Treatment.	Result.
49	female.	58	May 8, '72.	Normal.	Catarrhal ophthalmia supervened.	41 days.	v = $\frac{1}{2}$.
50	male.	67	May 21, '72.	Normal.	Irido-choroiditis ensued.	31 days.	
51	male.	80	May 27, '72.	Normal.		13 days.	v = $\frac{20}{100}$.
52	male.	73	May 27, '72.	Normal.		19 days.	Unrecorded.
53	male.	68	June 1, '72.			26 days.	v = $\frac{20}{60}$.
54	male.	57	June 3, '72.	Normal.	Blow on eye six days after operation; much hemorrhage into anterior chamber.	24 days.	v = $\frac{15}{60}$.
55	male.	71	June 3, '72.	Normal.	Hemorrhage into anterior chamber and iritis, capsule in pupil; secondary operation proposed.	39 days.	v = $\frac{5}{60}$.
56	female.	69	June 18, '72.	Normal.	An invalid for years, imbecile, requires to be constantly attended by daughter.	15 days.	v = $\frac{10}{100}$.
57	male.	74	June 28, '72.	Normal.	Some opaque capsule remained in pupil.	14 days.	v = $\frac{10}{60}$.

58	female.	65	July 11, '72.	Normal.	Cortical substance remaining in pupil. To return for secondary operation, but failed to do so.	18 days.	Unrecorded.
59	female.	64	July 13, '72.	Normal.		14 days.	v = $\frac{2 5}{6 0}$.
60	male.	55	Aug. 6, '72.	Normal.		18 days.	v = $\frac{1 0}{1 0 0}$.
61	male.	63	Aug. 6, '72.	Normal.	Panophthalmitis Phth. Bulbi one eye from blow.	45 days.	v = 0.
62	female.	45	Aug. 10, '72.	Normal.	Large floating opacities found in vitreous.	17 days.	v = $\frac{1 5}{2 0 0}$.
63	male.	23	Aug. 8, '72.		Iritis ensued.	24 days.	v = 0.
64	male.	74	Sept. 18, '72.		Pupil dilated slowly and slightly under atropine at time of preliminary examination. Probable entire corneal suppuration.	Still under treatment Oct. 1, 1872.	

REMARK.—It would seem from the foregoing table, that the average duration of after-treatment of these cases was 22.6 days; such, however, was not in reality the case, as many patients from remote parts of the country were kept in the Infirmary some time after they were in a condition to leave it, in order that an approximation might be made to the glasses they would ultimately require, and the expense of a second journey from home be avoided.

SUMMARY.

In the majority of these cases the disease was senile, one case of posterior polar cataract occurring in a patient aged 64. Of the nine comparatively young patients, one suffered from a gunpowder explosion, one from a blow, one from a cut, and one was the subject of sclerotico-choroiditis posterior.

The patients who lost an eye were aged respectively 70, 63, 63, 36, and 23. Iritis and closure of pupil took place with one of 85. Irido-choroiditis with one of 80 and one of 67; hemorrhage into anterior chamber with one of 71, while one of 71 died of pyæmia.

During the healing process iritis happened 3 times, irido-choroiditis 3, vitreous opacities developed once, and in one case suppuration of the cornea supervened on an attack of colic. One patient went out prematurely, in disobedience to orders, and lost his eye.

Seven patients required a secondary operation:—

1 aged 85, for consequences of iritis.
1 " 71, for capsular obstructions.
1 " 61, " "
1 " 57, " "
1 " 50, " "
1 " 24, " "
1 " 21, " "

The results of vision are as follows. Each fraction is given as recorded, and, where not reduced to lowest terms, expresses of course the distance from the test in which the patient stood:—

$\frac{20}{20}$	1
$\frac{20}{30}$	1
$\frac{2}{3}$	1
$\frac{20}{40}$	2
$\frac{1}{2}$	4
$\frac{20}{50}$	4
$\frac{20}{60}$	2
$\frac{10}{30}$	1
$\frac{25}{60}$	1
$\frac{12}{40}$	1
$\frac{15}{50}$	2
$\frac{15}{60}$	2
$\frac{1}{4}$	1
$\frac{10}{40}$	2
$\frac{20}{80}$	1
$\frac{20}{100}$	2
$\frac{10}{60}$	3
$\frac{15}{100}$	1
$\frac{1}{7}$	1
$\frac{10}{80}$	4
$\frac{5}{40}$	1
$\frac{10}{100}$	4
$\frac{5}{50}$	1
$\frac{1}{10}$	1
$\frac{9}{100}$	1
$\frac{15}{200}$	1
$\frac{5}{100}$	1
$\frac{1}{2}$	1
0	5
Died	1
	—
	54

Of the remaining ten unrecorded cases, two failed to present themselves for a secondary operation, which would undoubtedly have restored them to useful vision. One had had an attack of irido-choroiditis, and when last heard from was in an unpromising condition. The remainder left the Infirmary before their vision could be noted, or the records relating to them filled out.

STATISTICAL REPORT OF 1652 CASES OF DISEASES OF THE EAR,

TREATED AT THE MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY DURING THE YEAR 1872.

By DRS. CL. J. BLAKE, AND H. L. SHAW,

OF BOSTON.

CLASSIFICATION.

Congenital malformation	2
Othæmatoma (traumatic, spurious)	1
Fibrous tumor of lobe	1
Abscess of auricle	11
Obstruction of meatus from cerumen	246
Foreign bodies in meatus	16
Eczema of auricle and meatus	42
Exostosis of meatus	1
Wounds of meatus	2
Otalgia (auricle and meatus)	9
Otitis externa circumscripta	19
Otititis externa diffusa	115
Myringomykosis aspergillina	1
Myringitis	36
Calcareous deposits in membrana tympani	10
Atrophy of membrana tympani	2
Rupture of " "	3
Destruction of " "	6
Perforation of " "	62
Otitis media purulenta	287
Polypi accompanying otitis media purulenta	42
Polypoid granulations in middle ear and on membrana tympani	71

Otitis media catarrhalis chronica	488
Otitis media catarrhalis acuta	107
Otitis media catarrhalis serosa	8
Otitis media hypertrophica	5
Otitis media hæmorrhagica	1
Otitis intermittens	2
Otitis interna s. labyrinthica	10
Otitis interna associated with cerebral disease	4
Otitis interna associated with injury to cranium	2
Otalgia neuralgica	16
Tinnitus aurium, associated with cerebral disease	6
Deaf-mutes	18
Unfit	19
Unrecorded	22

NOTES TO THE PRECEDING TABLE,

By CL. J. BLAKE, M.D., OF BOSTON.*

The object of the following paper is to present such of the more interesting cases of disease of the ear as have been treated in the aural clinic during the past year. The fact that a large number of the patients come from distant parts of the State, renders it exceedingly difficult to keep an accurate record of results of treatment. This is to be regretted, as it diminishes the value of the statistics. The material afforded for observation, however, is so large, that individual cases of interest may readily be selected.

* The cases given in the table were treated in alternate quarters by Dr. Henry L. Shaw and myself, while the cases mentioned in the notes to the statistical report all occurred in my own clinic. I am greatly indebted to my colleague, Dr. Henry L. Shaw, for his observations in such cases mentioned in the above report as extended beyond my term of service.

CL. J. BLAKE.

Of the two cases of *congenital malformation*, the more interesting was that of the right ear in a girl three years of age, the left ear being perfectly normal, and the hearing good. In this case the long diameter of the auricle formed an angle of 45° with the vertical plane of the head; the position of the helix was barely indicated by a slight reduplication of the superior portion of the auricle, and the anti-helix represented by a slight elevation above the superior border of the concha; the whole of this portion of the auricle resembled that of the chimpanzee, or of the cases of dementia given by Prof. Laycock. The meatus was represented by a slight depression bounded anteriorly by a well-formed tragus, which latter was supplemented anteriorly by a small cartilaginous nodule, as in the cases described by Gruber. The perception for musical tones on this side of the head seemed to be good, and the integument covering the meatus could easily be depressed by means of a probe. Under these circumstances an exploratory operation was advised, but unfortunately the patient did not return at the time appointed. The family history gave no corresponding cases of malformation, and the patient herself was perfectly healthy and otherwise well developed.

The case of *spurious othæmatoma* occurred in a woman thirty years of age who received a severe blow upon the left ear from a fall, fracturing the cartilage and causing extravasation on both anterior and posterior surfaces of the auricle. Anteriorly the swelling extended from the fossa of the helix to the lower border of the concha, and posteriorly from the curve of the helix to about the centre of the concha.

Shortly after the accident, and following exposure, the auricle became red and painful; an opening one inch in length was made into the lower portion of the posterior swelling, resulting in the discharge of about one ounce of laudable pus, and the complete emptying of both sacs. The cavity was syringed with a weak solution of carbolic acid, and a cloth tent introduced; this was continued for about a week, after which, the walls of the sac being kept in apposition by means of compress and bandage, and the opening allowed to heal, the patient recovered rapidly with comparatively little deformity, the depression of the concha being only partially obliterated, and the elevation of the anti-helix being plainly discernible.

The *fibrous tumor* of the lobe occurred in a negro woman twenty-three years of age; that removed from the right lobe by means of the usual triangular cuts with the scissors was about an inch in diameter, and included the perforation which had been made for an ear-ring. The cuts were made to follow the outline of the tumor as closely as possible, and the edges brought together by means of straps, uniting by first intention for about a third of their extent, and healing finally with but little deformity. A fibrous tumor of nearly the same size was subsequently removed from the left ear of the same patient by Dr. Shaw.

Of the cases of *accumulation of cerumen* in the meatus in males, 39 occurred in the right ear, 53 in the left ear, and 59 in both ears; in females, 24 in the right ear, 33 in the left ear, and 27 in both ears. The average age of the cases collectively was 35 years. In the females, as a rule, the trouble had been of short duration, and the accumulated mass was soft and easily removed; in the males, on the other hand, the cerumen plugs were generally more firmly impacted, and the cerumen mingled throughout with fine dust or other foreign matter, which was sufficient, on closer examination, to indicate the occupation of the patient. Such cases occurred principally in coal-heavers and stokers, machinists, wood-turners, street-laborers, and stone-workers. The more obstinate cases were found usually in old men of the laboring class in whom there was a tendency to eczema of the auricle and meatus; in such cases it was the practice to soak the cerumen plug thoroughly with warm water, and then to pass a flattened probe between the ceruminous mass and the floor of the meatus to the depth of half an inch, thus making an opening for the entrance of the water in syringing.

Other instruments than the syringe were rarely employed in the extraction of these plugs, and as a preliminary treatment tepid water, as a rule, was found to be a better solvent than any of the solutions recommended by various writers. In clinical practice, where it is necessary to treat a large number of cases in a few hours, much time may be saved by filling the meatus with warm water, and introducing a large-sized Politzer's manometer, which may be refilled from time to time until the softening process is complete.

Among the more remarkable cases was one in a man 76 years of age; two firm plugs of cerumen filling the inner end of the meatus being found to be covered with a dense growth of aspergillus flavescens, the removal of the masses permanently relieved the symptoms characteristic of the presence of this fungus. The foreign bodies, consisting of beans, pins, insects, a piece of slate pencil, a round glass button and a small cockle-shell, were removed by syringing, with the exception of the three latter, in which it was necessary to resort to the forceps, the method of Löwenberg, and the blunt hook before the extraction could be effected.

Of the cases of *eczema of the auricle* and meatus, about 60 per cent. occurred in children under ten years of age, and of this number two-thirds were females, the disease affecting, as a rule, children of the very poor, poorly nourished, and unclean. The treatment in these cases consisted usually in the application of olive oil, which was allowed to remain over night, and washed off with weak warm soap-water in the morning; one or two applications were generally sufficient to soften the large crusts, and the subsequent treatment consisted principally in the use of the benzoated oxide of zinc ointment, as being more easy of application than any form

of wash, and in the more severe cases, in addition, a daily dressing of the parts affected with charpie dipped in a mixture of glycerine and water, to which the sulphocarbolate of zinc was sometimes added. In the adult cases the affection could usually be traced to exciting causes, among which the pernicious practice of cleansing the ear with a pin or ear-spoon played a prominent part.

The majority of the cases demanded general as well as local treatment, such as the use of tonics, preference being given to preparations of iron and quinine, and a more generous diet.

One of the cases of *wound of the meatus* occurred in a girl 11 years of age, who was recovering from a slight inflammation of the right membrana tympani. The point of a hard-rubber syringe had been thrust forcibly into the ear, tearing the integument of the meatus to the depth of half an inch, and rupturing the membrana tympani. The accident was followed by severe, deep-seated lancinating pain, accompanied by vomiting and occasional vertigo; the patient was brought to the clinic immediately after the occurrence of this accident, and an attempt to syringe the ear resulted in a severe attack of vomiting and considerable dizziness and dimness of vision. A leech was applied in front of the tragus, and instillations of warm water and the application of an ointment of the extract of hyoscyamus and morphia over the mastoid recommended. On the day following the pain was much relieved and the nausea and vertigo had not recurred; the tepid instillations were continued until the blood coagula had been entirely removed, when the wounds both of the meatus and membrana tympani healed readily with but slight impairment of hearing.

The second case was that of a laboring man, 36 years of age, who received a severe blow upon the region of the left mastoid, resulting in a slight wound of the meatus and an extensive rupture of the membrana tympani; there was considerable hemorrhage, which was followed one hour later by severe deep-seated pain, accompanied by nausea and

vomiting. On the second day a thin discharge appeared; this soon became purulent and offensive, and with the change in the character of the otorrhœa there occurred occasional attacks of vertigo, accompanied by deep-seated throbbing pain. At the time of admission the meatus was found to be somewhat congested, and the membrana tympani perforated, and giving passage to a copious purulent secretion. Syringing with the tepid water, the instillation of a warm solution of sulpho-carbolate of zinc, six grains to the ounce, and the internal administration of the hydrate of chloral relieved the pain and accompanying symptoms, and diminished the quantity and fetor of the discharge; the final result being a closure of the perforation and partial restoration of hearing.

The cases of *otitis externa circumscripta* were equally divided between males and females, the left being the affected ear in about 50 per cent of both. In both sexes the inflammation of the meatus accompanied some disturbance of the digestive organs, and was generally attended by constipation; in all but two or three cases there was a tendency to further development of furunculi, which was combated by general treatment, including a gentle laxative, tonics, and a more generous diet. The local treatment consisted, as a rule, in free incision and subsequent syringing with warm water. The full development of furunculi was sometimes prevented by the application of a saturated solution of nitrate of silver.

Of *otitis externa diffusa* over 57 per cent. were in females; the majority of the cases in both sexes occurring during the autumn and winter months, and affecting one side only.

As in the preceding affection something more than local treatment was required in most of the cases, the

patients being usually of the poorer class and ill nourished; in such as did not belong especially to this class, the trouble could be traced to some special cause, as direct injury to the part, or excessive exposure. Most of the patients had been suffering from severe pain for one or two days before applying for relief, and the disease was consequently at that stage which is characterized by extreme congestion and great tenderness, and to which the treatment recommended and employed by Gruber is especially applicable, namely, free incision of the congested parts, from one to three cuts, varying from a quarter to three quarters of an inch in length, being made from within outwards parallel to the long axis of the meatus, bleeding being encouraged by subsequent syringing with warm water. Aside from the almost immediate relief afforded by this method of treatment, it possesses the further advantage of arresting the progress of the inflammation, and preventing structural changes which might have a subsequent effect upon the hearing. One of its drawbacks is the possibility of the recurrence of granulations springing from the edges of the cuts. This complication, however, generally accompanies only cases in which the incision has been delayed until the parts have become œdematous.

The cases recorded under the heading *myringitis*, were those in which the membrana tympani was especially the seat of inflammation, and the affection being one which seldom occurs uncomplicated, a more careful record was kept with the view of ascertaining so far as possible the cause. Of the thirty-six cases recorded, 8

occurred in the month of August, all of them in males, of whom 7 were under thirty years of age; and in 5 of these the inflammation was directly traceable to sea-bathing as the immediate cause. In July there were 6 cases of myringitis, all of them in males, and in 2 cases traceable to sea-bathing. In March, April, and May preceding, there were no cases recorded.

In February, 4 cases, 3 being females. In January, 8 cases, 5 males and 3 females; of these latter, all of the males, with one exception, were under thirty years of age, and engaged in occupations which implied exposure to cold and wet, and to sudden changes of temperature.

In December, 2 cases, both females, the disease being directly traceable to exposure to inclement weather. A further review shows that those cases of myringitis occurring during summer months were principally in young males, and traceable to a cause pertaining at that season, while of the cases occurring during the winter months, more than half were females under thirty years of age; and of the males 50 per cent. were children under ten years of age, and the remainder young men whose occupations rendered them liable to exposure.

A comparison with private records confirms the conclusions which would be drawn from the above table with regard to the ætiology of myringitis; the majority of cases, during the summer months, occurring in young males during the season of sea-bathing, and more or less directly attributable to the effect of cold salt-water entering the ear; during the winter months myringitis occurred more frequently in young females with the

advent of snowy weather, and with the cold wet weather of spring-time, there being fewer cases, as a rule, in the interim during settled cold weather, and these cases occurring principally in males as the result of especial exposure. The majority of the cases applying at the Infirmary were in the acute stage of the disease, the membrana tympani being much congested and swollen, the point of insertion of the malleus being represented by a depression, and the inflammation being accompanied by considerable congestion of the meatus; the hearing had generally decreased to a minimum, being on an average from $\frac{1}{12}$ to $\frac{5}{12}$ for the watch. The immediate treatment in most of these cases consisted in *free scarification of the membrana tympani*, from two to four cuts being made in each case, the points selected for incision being those of greatest prominence or greatest degree of congestion, care being taken not to cut through into the tympanum. The amount of hemorrhage was in no case sufficient to fill the inner end of the meatus, but the pain and sensation of fulness were almost immediately diminished and the hearing increased.

Subsequent treatment consisted in the use of the air-douche or catheter, preferably the former, and such general treatment and attention to the condition of the pharynx as the case required. As a rule, it was not necessary to repeat the scarification.

Of the cases of *otitis media purulenta* 51 per cent. were males of an average age of 21 years; the average age of females suffering from the same disease being 15 years; of males 20 per cent. and of females 36 per cent.

were under 10 years of age. In about 25 per cent. of these cases, in both sexes, the purulent inflammation was accompanied by the presence of granulations springing from the middle ear, or from the outer surface of the membrana tympani.

In the majority of these latter cases, the otorrhœa had persisted for a considerable time, but in a few patients in whom perforation of the membrana tympani and purulent discharge were found accompanied by well-marked granulations, the commencement of the disease dated back from two to three weeks only. Such cases occurred principally during the winter months in young males, and the granulations were generally noticeable for their exuberance, and for the readiness with which they disappeared under the application of nitrate of silver.

Among the more obstinate cases were two in which there existed in addition to perforation of the lower portion of the membrana tympani an opening above the short process of the malleus. In both of these cases the larger portion of the purulent discharge found its exit from the middle ear through the inferior opening, while the cavity above was filled with soft granulations, which could be reached only through the superior opening. In addition to the usual treatment, strong solutions of the sulpho-carbolate of zinc were injected through the latter perforation by means of a middle ear-syringe, and pledgets of cotton-wool soaked in a saturated solution of nitrate of silver were introduced every alternate day. Under this treatment the granulations finally disappeared, the discharge diminished, and a very vexatious complication was overcome.

The treatment in uncomplicated cases of purulent otorrhœa consisted in frequent and thorough syringing with tepid water and the instillation of solutions of the sulpho-carbolate of zinc, of from four to ten grains to the ounce; this double salt seems to have a more beneficial effect in such cases than solutions of the sulphate of zinc of the same strength, and possesses the still further advantage of more appreciably diminishing the fetor of the discharge.

In long-continued cases the saturated solution of nitrate of silver was applied with good results, especially in children, and in several cases where the discharge was distinctly muco-purulent Yearsley's treatment of packing the middle ear with dry cotton wool had a beneficial effect. In such cases it was the practice to cleanse the ear thoroughly by means of the air douche and syringing, and after drying to pass small pledgets of fine jewellers' wool through the perforation in the membrana tympani, packing them in by means of a probe. These could be easily removed on the following day and the packing repeated. The discharge gradually diminished in quantity and became more tenacious, so that towards the latter part of the treatment it became necessary to moisten the pledgets slightly before extracting.

Of the more serious cases of purulent inflammation of the middle ear there were none in which it became necessary to open into the mastoid cells, although redness, swelling and tenderness over the mastoid region were not rare accompaniments during the winter months. These patients were taken into the Hospital, if possible,

and leeches freely applied behind the ear, in each case with relief and a subsidence of the alarming symptoms.

Of the cases of *otitis media catarrhalis chronica* 52 p. c. were males, with an average age of thirty-five years; and 48 p. c. females, with an average age of thirty-four years; and in about 95 p. c. of the cases in both sexes tinnitus aurium was or had been a prominent symptom of the existence of disease. In addition to the usual application to the pharynx and naso-pharyngeal space ordinarily required in these cases, and the use of the air douche and catheter, with the injection of medicated solutions and vapors, repeated myringotomy was resorted to by the writer in several cases.

The cases chosen for this treatment were those in which the disease had persisted for a long time, the hearing being very considerably diminished and the Eustachian tube with difficulty permeable, the perception for sound conveyed through the bones of the head, however, being good, and the membrana tympani concave, thickened, and opaque, but without congestion, calcareous deposits or further structural change. The operation was performed with the adjustable myringotome, and repeated every third or fourth day, different portions of the membrane being chosen for each incision; during the experiment all other treatment, with exception of the use of the air douche, was suspended. In all cases the openings healed readily within forty-eight hours, and without perceptible improvement, until after the third or fourth incision had been made, when the Eustachian tube was found to have become much more readily permeable, the hearing to have increased in

varying degree, and in some cases the tinnitus aurium to have sensibly diminished. The theoretical grounds on which this treatment was instituted, and the reasons for improvement, probably are the diminished resistance to passage of air into the middle ear through the Eustachian tube, the membrana tympani being perforated; and, secondly, the irritation consequent upon the repeated incisions resulting in a diminution of the thickening of the membrana tympani. In none of the above cases was there any liberation of secretion in the middle ear by means of the incisions which would account for the improvement in hearing; these cases, moreover, improved still further under subsequent treatment by means of the catheter.

In the cases of *serous accumulation* within the middle ear, of which six were males and two females, myringotomy was also resorted to as the readiest means of arriving at an early termination of the disease, in all cases with beneficial results, and, so far as could be determined, without subsequent detriment to the hearing. In one case in which the peculiar form of sac described by Politzer* persisted after the liberation of the secretion, repeated incisions were made which resulted in a contraction of the sac and considerable improvement in hearing.

The two cases of *otitis intermittens* occurred in males who were subject to malarial fever. The affection was characterized by pain of a neuralgic character, conges-

* Beleuchtungsbilder des Trommelfells. The Membrana Tympani in Health and Disease. Translated by Drs. A. Mathewson and H. G. Newton. W. Wood & Co., New York. 1869.

tion of the membrana tympani, and accumulation of secretion within the middle ear; the attack was in each case coincident with general malarial symptoms, and followed the course of the febrile attacks in its increase and abatement. In both cases local treatment of the aural trouble gave no relief until supplemented by the administration of quinine, when the aural symptoms disappeared with the subsidence of the primary affection.

Of the cases of *deaf-mutism* 61 per cent. were males; in four of these cases the loss of hearing dated from an otitis media purulenta following scarlet fever, and in three cases, in which the membrana tympani was of normal appearance, the deafness was traceable to a disease, the symptoms of which agreed with those given by Voltolini* as characteristic of otitis labyrinthica.

In connection with the cases of perforation of the membrana tympani a series of *experiments* was instituted *with regard to perception of high musical tones*, a summary of which has already been published.† Cases in which it was necessary to perforate the membrana tympani were also availed of for the same purpose, the object being to account, if possible, for the discrepancy in the statements of various authors with regard to the limit of perception of high musical tones, and also the limit of such perceptions, and the conditions of the sound-conducting portion of the ear favorable thereto.

For this purpose a series of König's rods of white tempered steel, ranging from 35,000 v. s. to 85,000 v. s.

* Monatsschrift für Ohrenheilkunde.

† Transactions of the American Otological Society, 1872.

was employed, the rods being suspended at a uniform distance from the ear by means of loops of fine wire and set in vibration by a stroke from a steel hammer. The results obtained were such as not only to stimulate to still further investigation, but to establish the value of the instrument for diagnostic purposes. In the majority of the cases of chronic catarrhal inflammation of the middle ear the limit of perception terminated at 35,000 v. s.; in the exceptional cases it reached 40,000 v. s., and even 50,000 v. s., but in these cases the membrana tympani was found to be very concave, uniformly thickened, and varying its position but slightly under the action of either the air douche or catheter. This correspondence between the perception of a higher tone and a concave membrana tympani would be accounted for by the increased tension of a membrane of uniform thickness, responding more readily to shorter sound waves. The same point was illustrated in a case of *voluntary contraction* of the musculus tensor tympani.

The patient was a woman thirty years of age, who applied at the Infirmary for relief from a slight pharyngeal catarrh. The membrana tympani was transparent and of normal appearance, with exception of a slight central depression, the result of temporary closure of the Eustachian tube.

Upon voluntary contraction of the muscle the long process of the malleus was seen to move inwards, together with the central portion of the membrana tympani, the hearing for the voice and for all deeper tones diminished, and that for higher tones increased from 35,000 v. s. to 40,000 v. s.

The same observation was confirmed in another case occurring in private practice, in which the perception for high tones increased from 40,000 v. s. to 50,000 v. s.

during contraction of the musculus tensor tympani, the hearing for deeper tones proportionately decreasing. In this case the hearing was fully normal when the muscle was not voluntarily contracted. In cases of perforation of the membrana tympani in which the opening had become closed by the formation of a cicatrix, the perception for high tones was increased, provided, however, that the cicatrix was firm and tense; if at all relaxed the perception for higher tones seemed to be diminished; the only exceptions to this rule occurred in cases where the cicatrix was in contact with the descending process of the incus; in one case, in which a band of cicatricial tissue extended from the posterior edge of the perforation to the lower end of the long process of the incus a tone of 55,000 v. s. was distinctly heard. In two of the three cases of otitis media catarrhalis in which the test with the König's rods was supplemented by the application of the galvanic current the perception for high tones was increased 5,000 v. s. during the passage of the current, the cathode being applied in front of the ear and the anode held in the hand of the opposite side. The same increase of perception under the use of the cathode with from four to eight cells of a Stöhrer battery was found in corresponding cases in private practice.

Of the cases at the Infirmary during the past year in which *electricity* was employed either *as a means of diagnosis or of treatment*, two may be cited as showing especially beneficial results.

The first patient, a female, sixteen years of age, applied at the Infirmary, in July, for relief from deafness of the left ear, which had been

first noticed six years previously, and had gradually and steadily increased without tinnitus aurium or other subjective symptoms.

The watch (72 inches normal hearing distance) was not heard when pressed upon the auricle, or in contact with the head; the tuning-fork was heard only slightly. The meatus was normal, the membrana tympana somewhat concave, and very slightly opaque, and the Eustachian tube free. The general health was good, with exception of a slight tendency to constipation; the menses, which had appeared two years previously, were regular. The current from six cells of a Stöhrer battery was applied at intervals of three days, the cathode in each case being applied in front of the tragus; there was no dizziness and no subjective symptom, with exception of a slight ringing on the opening of the cathode. Following the first application of electricity, the hearing increased to contact for the watch, and continued to increase steadily with each application until the eighth sitting, having reached a distance of eighteen inches, when the patient unfortunately passed from observation.

In the second case, that of a woman thirty years of age, both ears were affected, the hearing having steadily diminished during a period of four years. Within three months there had been occasional tinnitus aurium. On both sides the meatus was normal, and the membrana tympani very slightly opaque, and somewhat concave. On the right side there was no perception whatever for the watch, while on the left the perception was good, and the watch was heard at a distance of four inches from the auricle. The general health was good, and there was nothing in the history or the appearances to account for the deafness, with exception of a slight catarrhal trouble of the middle ear; there was, moreover, no improvement in hearing following the use of the air douche.

No formula of reaction could be obtained on account of the vertigo accompanying the use of more than eight cells of the Stöhrer battery; but under the use of the cathode, with six cells, the hearing improved in the right ear to contact with the watch, and in the left ear to six inches for the watch.

The same current was applied at intervals of five days from August 5th to August 20th, at which date the hearing in the right ear re-

mained the same, but in the left ear had increased to twenty-eight inches. The patient was next seen on November 6th. The hearing had not diminished, and was still further increased to thirty-six inches.

It was necessary to refer many interesting cases of deafness associated with cerebral disease, and with injury to the cranium, to other institutions, on account of the necessity of retaining all available beds either for operative cases in the ophthalmic department, or for cases of accident requiring hospital treatment.

MINOR OTOLOGICAL COMMUNICATIONS.

By DR. S. MOOS.*

Translated by J. A. Steurer, M.D., of New York.

I. UNSUCCESSFUL ATTEMPT TO EXTRACT A COFFEE-BEAN LODGED IN THE EXTERNAL AUDITORY MEATUS—CONSECUTIVE PURULENT INFLAMMATION WITH PERFORATION OF THE DRUM MEMBRANE, EXFOLIATION OF THE INCUS, AND DEVELOPMENT OF NUMEROUS POLYPI—PASSAGE OF THE BEAN THROUGH THE PERFORATION INTO THE TYMPANUM AND OUT AGAIN—CICATRIZATION OF THE PERFORATION WITH PARTIAL RESTORATION OF HEARING.

J. L., æt. 3½ years, of Baden-Baden, was brought to me by her parents Dec. 9th, 1867. The little patient had put a coffee-bean in her right ear on Dec. 3d. According to the parents' statement the bean was not far in, and it could be seen. A physician made that evening and the following morning several unsuccessful attempts to extract it by means of instruments, having narcotized her by chloroform. After which the bean could be seen no longer.

In consequence of the pain attending the attempted extraction, and the effects of the chloroform, the child became excited and unwell, and there was a continual purulent discharge from the ear; on that account the physician deemed it unadvisable to do anything further, and gave the opinion that the foreign body might remain in the ear without any bad result.

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* This paper appeared in No. 2, vol. ii., of the German edition of the Archives, issued July, 1872.—EDITOR.

The examination on the 9th of Dec. gave the following status: Great pain when pressure was made on the right tragus, and on traction of the auricle, erysipelatous redness of the tragus and concha, occlusion of the meatus by tumefaction of its walls, and slight purulent discharge. Under these circumstances I recommended antiphlogistic treatment, and declined any operative procedure. Requesting further news, I received, on Jan. 9th, the following account: "The condition of the ear has remained apparently the same, the purulent discharge is mingled with blood, but the child is lively, and free from pain. During the last few days I observed a reddish mass filling the meatus, which could not be removed by syringing. The physician who was called declared it to be a polypus which had formed in consequence of the inflammation."

Upon being asked to write my opinion, I declared the polypoid formation to be not merely a result of the inflammation, but also an indication that the foreign body was still in the ear. I was invited to go to Baden, and if any operation should be deemed necessary to perform it there. I fulfilled this request on Jan. 14th.

The examination showed a multiple polypoid formation which had advanced into the external meatus. I declared the removal of the same to be necessary—without any consideration to the foreign body—to prevent any possible retention of pus, and therefore I gave chloroform and performed the operation. It lasted two hours. A great number of granulations which originated from all parts of the meatus down to the membrana tympani had to be removed. The incus, partially exfoliated in consequence of the purulent inflammation of the drum membrane and tympanum but otherwise normal, lay embedded in the granulations. No foreign body could be discovered, even after removal of the granulations, which permitted a careful examination of the membrane and of the tympanum through the perforation. The posterior half of the membrane was destroyed, its anterior half and the mucous membrane of the tympanum as seen through the perforation were reddened and swollen; but no foreign body could be seen or felt, even after repeated probing of the tympanum. However remarkable it may appear, I had no doubt but that the foreign body had wandered into the tympanum and there remained concealed

from view. I therefore desisted from all further attempts, ordered the patient to lie on the affected side, and have the ear syringed with a concentrated solution of alum twice a-day.

According to the written report of Dr. Seelos the progress of the case was as follows :

Jan. 22d. The child has remained free from fever and pain. Her general health is very good, the purulent discharge moderate, but slightly tinged with blood. The inflammation in the external meatus has diminished, but near the membrane there are ulcers and granulations. The perforation of the membrane still exists, and the mucous membrane beyond it is still granular.

Jan. 31st. Yesterday the bean came into view by syringing. About eight days ago the child was feverish and complained of headache, but these symptoms disappeared before the bean became visible. The child is now feeling quite well. I continue the syringing and alum solution.

The further communications may be condensed into the following: The inflammation diminished gradually, the discharge ceased; and I found the following condition when her parents brought her to me at the end of March. She heard a watch of 6 feet hearing distance at 5 inches; understood speech at 18 paces; external meatus dry. No perforation in the membrane. A large cicatrix in the membrane, whose anterior boundary is formed by the handle of the malleus. On Oct. 7th, 1871, I had another opportunity to examine the ear of the little girl at Baden. The same watch could only be heard at a distance of 3 inches; but on the other hand the patient could repeat whispered sentences at the distance of 12 paces with great facility. The drum membrane had a very different appearance, only the periphery seemed normal. The whole central portion appeared like an atrophic spot or a large cicatrix. Notwithstanding the great transparency of the membrane, neither the malleus nor the chorda tympani could be seen, but directly upwards I could see the short process, and in the superior anterior quadrant the head of the stapes. The central portion was drawn towards the promontory. Since March 18th, 1871, the child had never complained of her ear.

From the above case we learn the following:—

I. That a foreign body, which cannot swell, lodged in the meatus, and being confined there by the tumefaction, may pass into and out of the tympanum through a perforation in the membrane. In such a case the perforation may occur in consequence of the inflammation or may have existed previously.

II. A partial atrophy of the drum-head may gradually become complete. The gradual progression of the atrophy is favored by the retraction of the handle of the malleus by the tensor tympani, the membrane offering less resistance to the atmospheric pressure. The latter very likely occurred in our case afterwards, that is after the inflammation had diminished, between the end of March, 1868, and the beginning of October, 1871, which was the interval between the two last examinations, for on the last examination but one I could still distinguish the handle in the membrane. In consequence of the suppurative inflammation the manubrium was probably loosened from its connection with the membrane or the scar whose anterior boundary it formed, and was more easily drawn backwards and upwards by the tendon of the tensor tympani as the atrophy of the membrane progressed.

III. The conduction of the sound waves in our case took place in the following peculiar manner: the waves were transmitted from the external meatus to a thin membrane of connective tissue, from this membrane—the handle being absent, and the incus having been exfoliated by the former inflammation—to the air in the tympanum, and thence to the stapes. This condition was very unfavorable to the perception of faint sounds,

for instance the tick of a small watch; but its influence was less apparent in the hearing of ordinary voice, and even whispers.

Taking everything into consideration, we can suppose that the hearing power will not be further diminished, because the pathologico-anatomical changes, as far as they can be determined by ocular inspection, have probably reached their maximum.

II. ALARMING HÆMORRHAGE FROM THE EAR AFTER EXTRACTION OF A SMALL POLYPUS FROM THE SHORT PROCESS OF THE MALLEUS, NECESSITATING A TAMPOON.

Miss H., æt. 18, was brought to me by her father April 16th, 1867. Since an attack of scarlatina in her 6th year there had been a purulent discharge, sometimes mixed with blood, from both ears. The examination discovered on the right side at the inner end of the external auditory passage, on the upper wall, a heart-shaped exostosis similar to the one which I have more minutely described in Vol. II., No. 1, p. 136, etc., of these Archives, further, destruction of the drum-head excepting at the periphery, and the handle drawn against the promontory. On the short process was a granulation as large as a pea; the mucous membrane of the promontory was grayish-red, thickened, and covered with pus. On the left side there was no exostosis, but the inner end of the canal was occupied by a polypus as large as a hazelnut, which rendered the examination of the membrane unsatisfactory; but after its extraction there appeared a large perforation of the membrane with destruction of nearly all the anterior half. The posterior half was depressed with the handle, dull, but otherwise normal. May 14th, the patient came for operation, and on the next day at 10 o'clock in the forenoon the right side was attacked. The exostosis above described rendered the operation rather more difficult than usual, but the extraction of the granulation was accomplished by means of a "Wilde's snare," and its site was thoroughly cauterized by means of a nitrate of silver crayon. Seven hours later, during which the patient had re-

mained quiet in the house, the right ear began to bleed. As soon as the patient observed this she walked to my house, a distance of about four blocks, to have her ear examined.

Not finding me at home, she obtained a dish to catch the blood. I was sent for, and reached the house in about three-quarters of an hour. By this time the patient was quite anæmic, for she had lost probably from 20 to 24 ounces of blood. The right auditory canal was filled with a coagulum. After removal of the clot, blood spirted out from the depth in a bright red stream, and the flow was not controlled by compression of the right carotid artery.

I at once made a tampoon by pressing a wad into the furthest extremity of the auditory canal, sprinkling upon it a layer of powdered alum; then another wad, likewise covered by powdered alum, and so on, until the auditory canal was crowded full. Then a firm ball of charpie was placed upon the auricle, and a bandage applied snugly over all. The patient was sent home to bed, and the strictest rest enjoined her. There was no more bleeding.

After two days the tampoon was removed, and the auditory canal was carefully cleaned out. When the tumor had been removed there was a thin, dark coagulum, as large as a lentil. The ear was not disturbed for several days; there was no return of the discharge; and nothwithstanding the loss of the membrana tympani, entire absence of the incus, and in-drawing of the handle to the promontory, the patient was able to understand ordinary conversation without the use of an artificial drumhead; hearing distance for my voice was seventeen paces, and three feet for a watch of thirty feet hearing distance.

Unhappily, I neglected to examine the small tumor, but I have no doubt that it was a case similar to the one described by Dr. Buck in vol. ii., part 1, page 72, etc., of these Archives. In that case the tumor was attached to the handle of the malleus by a long pedicle, and the examination showed it to be a polypoid angioma cavernosum.

The hemorrhage was not so considerable as in my

case, where probably it came from the vascular matrix of the tumor, exposed by the separation of the slough seven hours after the cauterization. I must confess that in the first moment, when I saw the profuse bleeding, and after the removal of the coagulum, the blood spurting up from the depths of the auditory canal, I feared that I might have cauterized the carotid artery; and this was partly justified by the considerable destruction of the organ and the long duration of the disease; but, on the other hand, the negative result of compression of the carotid and the positive result of the tampoon in the external auditory canal disproved this supposition.

III. EXUBERANT DEVELOPMENT OF ASPERGILLUS IN THE EXTERNAL AUDITORY CANAL, WITHOUT SYMPTOMS OF ANY IRRITATION.

According to the observations of Schwartze,* Wreden,† and others, fungous growths in the external auditory canal are frequent causes of obstinate and recurrent chronic inflammations. Schwartze considers this mould as purely accidental; but Wreden ascribes to it an importance in the phenomena of inflammations of the auditory canal and drumhead similar to that of oidium albicans in sprue or microsporon furfur in pityriasis versicolor.

According to Wreden, fungous growths are ordinarily not accompanied by suppuration of the auditory canal

* Archiv. f. Ohrenheilkunde Bd. II. S. 5.

† Myringomycosis Aspergillina and its Influence upon the Organs of Hearing, by Dr. Wreden, St. Petersburg, 1868.

or drumhead; and he considers the discharge from the ear, if there be any, rather as a serous exudation caused by the irritative influence of the mould upon the living tissues. In the following case there was no suppuration either, and it was further remarkable on account of the absence of all objective changes and subjective complaints, with the exception of hardness of hearing, as well as the speedy and happy termination

Mr. St., fifty-four years of age, consulted me Feb. 11th, 1871, on account of hardness of hearing on the right side—indeed his hearing was so diminished that he could hear conversation only in a few paces, and a watch of thirty feet normal distance, only at four inches. Conduction of bones present. Now and then, especially when heated, he had noises in the ear, otherwise no complaint, no itching, pricking, or ear-ache. Ocular inspection discovered a plug which was removed by syringing. The black discoloration of the plug extending quite to its periphery suggested a microscopic examination which revealed that the outer layers consisted of epidermis cells thickly covered with aspergillus glaucus.

The deafness and noise ceased after the removal of the plug. The handle was found hyperhæmic two days later, but the rest of the drumhead and the meatus were normal. During the succeeding four days the meatus was treated with a 10 gr. solution of argentum nitricum. There was no return of the disease; four weeks later there was no appreciable anomaly. In November, 1871, I had an opportunity to examine the patient again; I found the ear normal in every respect, and nothing unusual had been noticed by the patient.

IV.—GUNSHOT WOUND OF THE EUSTACHIAN TUBE.

The following case in reference to the impermeability of the tube, is analagous to that of Dr. Wolff*; for this

* These Archives: vol. ii., No. 2, p. 58, etc.

reason and especially for its rarity, I will report it briefly.

David Kilian, æt. 28, of the 67th reg. Prussian infantry, was wounded at St. Marie, Jan. 13th, 1871. The ball entered below the lobe of the left ear, immediately behind the angle of the lower jaw, and passed out through the right upper jaw. Consciousness was not lost. Much blood and pus soon came from the mouth; during the first three weeks swallowing and speaking were almost impossible. There was marked fever, and for two days and nights ice was kept to the head. On the 11th of February the patient came to Heidelberg, and on the 23d of March he was sent to me by Dr. Mittermaier.

Status on the 23d of March.

He speaks very indistinctly and swallows with difficulty. There is a radiated cicatrix on and immediately below the left lobule which is more closely attached to the neighboring parts and less mobile than the right. There is a second ⊢ shaped, partly granular and still suppurating scar in the middle of the right cheek; the right eye is open, somewhat lachrymose, and less easily closed than the left (facial paralysis in consequence of injury to the last branches of the ansa nervi facialis). In the left hard palate is a deficiency, large enough to contain a nut, lined with pus. In the external auditory canal there is some dried blood, but no trace of a wound; its inner end and the handle are hyperæmic; the membrana is flat, lustreless, but so translucent that its posterior half permitted me to recognize a yellowish material in the tympanum. When the tuning fork was placed on the left side of the head it was heard; the bone conduction for the watch was feeble, and air conduction only on contact of the watch with the auricle. The voice was heard only in the immediate vicinity of the ear.

Pharyngoscopy, practised in the usual manner, and by means of a very small mirror placed in the deficiency of the left palate, was unavailable on account of the persistent and considerable suppuration from the palate.

The patient complained of constant hissing in the left ear, occasional slight pain in the left side of the head, and vertigo: but he stated that these symptoms had been present before the injury.

The right ear was healthy.

A paracentesis was then made in the lower posterior quadrant of the left membrana tympani; but inflation of the drum to clear it from the exudation was impossible, for Politzer's method was impracticable on account of the condition of the palate, and although the catheter could be introduced no air could be got into the middle ear. The exudation was finally removed by the method advised by Politzer in the Wien. Med. Wochenschr., 1870, No. 41, viz.: an airtight auscultation-tube was pressed into the external meatus and repeated suction made with the mouth. A thick yellow material was drawn into the external meatus. Slight otorrhœa set in.

March 24. Another unsuccessful attempt to get air through by the catheter. The more the column of air was forced the greater became the sensation of resistance. Suction was repeated but nothing came out; the subjective noises, however, were diminished, and the hearing distance increased to $1\frac{1}{2}$ ft. for the watch and 15 paces for the voice.

March 25. Handle hyperæmic, drum-head grayish opaque. The perforation is still perceptible and there is a slight yellowish discharge through it. Hearing the same as yesterday. Catheter again unavailable.

March 26. No discharge. Handle hyperaemic; anterior half of membrana tympani gives a bright reflex, but the posterior half is dull. Perforation healed. Eustachian tube still impermeable. Hearing distance 3 ft. for the watch and 10 paces for the whispered voice, a little subjective noise. The patient, unfortunately, had to be discharged.

In this case the Eustachian tube was probably occluded by the suppurative inflammation, following the shot wound, and to this occlusion must also be ascribed the presence of the exudation in the tympanum. The improvement of hearing which followed the paracentesis and withdrawal of the exudation I consider only temporary, for, if the tube really was wounded, the unavoidable cicatricial occlusion of the canal will produce a permanent disturbance in the mechanism of the tympanic apparatus.

PATHOLOGICAL OBSERVATIONS ON THE PHYSIOLOGICAL SIGNIFICANCE OF THE HIGHER MUSICAL TONES.

By Dr. S. MOOS.

(Translated by Dr. E. Gruening.)

My attention was called to the subject under consideration by a case of disease which I described in vol. I., part 1., p. 332 of these Archives, under the heading of peculiar disturbances of hearing after cerebro-spinal meningitis. One peculiarity of these disturbances was, that with the left ear the patient was unable to hear the lower tones of the musical scale. He could not perceive the twelve lowest tones of a piano of seven octaves nor the *e* of the large octave. The patient remained deaf as regards these tones, but gradually regained the power to perceive speech even at a distance of 36′. From this solitary case I could have drawn the conclusion, that for the appreciation of speech these low tones were most probably not essential. On considering, however, the lack of similar cases in literature, I deemed it prudent to postpone my conclusions, and await the opportunity of making further observations.

The drumhead has no light spot; the mucous membrane is opaque. Curvature and position of membrane normal. No hyperæmia of handle of hammer.

The examination of the left ear with the constant current gives a negative result, no reaction being produced with 30 Siemens-Halske's elements, even when, after a prolonged action of the anode, the current is turned to the cathode.

On February 4, condition unaltered. A systematic galvanic treatment is begun. Thirty elements (anode action) have no effect upon the subjective noises. (These are still likened by the patient to the noise of water dashing against the shore.) Reversion of the current (30 elements) from the anode to the cathode neither intensifies the existing noises nor creates additional auditory sensations. The watch is heard from the left temple and in contact with the auricle. No change as regards the hearing of tuning forks and speech. Iodide of potassium discontinued.

February 6. The patient states that the noise of the streets drives him to desperation. He suffers terribly from noises, especially in the left side of the head. To-day the functional examination before and after treatment gives the same result as on February 4. The electrical treatment produces a different effect. At the anode closure (30 elements) the noise ceases completely. On turning the current to the cathode a singing tone of high pitch is produced, which lasts through the duration of the cathode, disappears at the opening of the cathode and the closure of the anode, and reappears, somewhat diminished in intensity, at the opening of the anode. I advised the patient to play the piano, with his left ear tightly closed, and to notice whether he could perceive the tones more distinctly. This experiment gives no favorable result, the tones being heard as confusedly as before. Ordinarily the patient is free from vertigo; this, however, appears, whenever he moves his head either forward or backward. (The patient never complains of vertigo during and after the electrical treatment.)

Currents of various intensity (from 30 elements down to 18) give the same result formerly obtained with 30 elements only. Tuning forks and watch heard as before. Speech at 4′.

February 18. The same formula is obtained with a current of 6 elements. (No reaction with a current of 3 elements.)

Ca Cl — Ringing″
Ca D — Ringing′ ∞
Ca O — o
An Cl — o
An D — o
An O — Ringing′

During the action of the anode the subjective noises invariably cease. After the opening of the anode they reappear sometimes in one hour, sometimes in several hours.

February 19 to 24. Same condition. Hearing distance 16′.

February 25. Dizziness and noises lessened. Speech at 16′. A constant current of 15, 12, 9, and 6 elements gives the formula of so-called hyperæsthesia according to Brenner. The subjective noises abate during the action of the anode, but do not cease completely with less than 30 elements.

The galvanic treatment was continued daily till March 18. The result was as follows: Speech was heard at a distance of 16′. Watch and tuning forks (by conduction through the bones of the head) as before. The subjective noises either diminished or ceased completely during the action of the anode, and were still intensified by external noises.

The subjective noises were neither increased by beats nor by the single tones of the musical scale. These and the following facts were noted by Prof. Helmholtz, who kindly examined the patient. The patient heard the lower tones and the whole octave of c′ distinctly, the first four tones of the next octave, from d″ to g″, indistinctly, and the higher tones not at all.

Epicritical Remarks.—The above-described case is a representative of a form of disease not rarely met with. It was first described by Ménière, and recently fully discussed by Knapp in these Archives, vol. ii., part i., p. 204. In the history of this case we find absolutely no cause which may account for the sudden

annihilation of the function of the left ear (apoplectiform deafness of Knapp). The patient was only 53 years of age; his heart was sound; and still it is possible that, owing to an atheromatous condition of the arteries, a hæmorrhage ensued into the left inner ear. Nothing else can have taken place. This hæmorrhage, producing a paralysis in the cochlea and an irritation in the vestibule, occurred with a loud report heard by the patient only.*

Though the patient stated that he had never suffered from any affection of the ears, still it is evident from the opacity of the left drumhead and the impairment of hearing as regards the watch on the right side, that the organ of hearing was not intact previous to this attack. This has often been observed in cases of Ménière's disease. While in most cases the subjective noises are quenched by the objective, and increase in solitude and especially during the night, it was quite the reverse in this patient. His noises either diminished or ceased completely in solitude and during the night, and increased by objective noises, especially the din of the street, and also by music. This condition may be explained in the following manner: In the majority of cases subjective auditory sensations are caused either by an increase of intra-aural pressure, by changes in the labyrinth, or by a combination of both conditions, e. g., in the so-called chronic catarrh of the tympanic cavity.

* The seventh case of Ménière is analogous to our case. See Knapp: A clinical analysis of the inflammatory affections of the inner ear. Arch. Ophth. and Otol. Vol. ii., Part i., p. 230. "A young lady felt suddenly a 'coup de sang' in her left ear, etc."

In our case the hæmorrhage produced primary changes in those parts, by means of which, according to Helmholtz, noises are perceived (membranous sacs; ampullæ). The anatomical lesion consequent upon the hæmorrhage did not annihilate, as it appears, the function of these parts, but left a condition of irritation which showed itself particularly under the influence of objective noises, while quietude, repose, and seclusion acted soothingly. It is evident that this state of irritation in the vestibule interfered materially with the musical appreciation of the comparatively healthy ear. As often as the patient heard music in close proximity or played himself, noises of great intensity were produced in his left ear, which rendered him incapable of judging competently of musical tones and clangs, and finally caused an intolerable musical confusion. As the mechanical closure of the left ear could not counteract this effect, the irritation must have been intense. The conduction of the musical tones through the closed ear (and the bones of the head?) were still sufficient to confuse the musical perception. In the cochlea the hæmorrhage caused at first a complete and finally a partial loss of function. The nervous fibres were paralyzed: this is proved by the observation that, at first, the most intense galvanic currents failed to produce a subjective auditory sensation; later, the auditory nerve reacted, and the patient presented the symptoms of a partial loss of the cochlear functions. The nervous fibres serving for the perception of the higher musical tones were principally involved. The perception of speech returned in a limited degree. The permanent loss of musical perception was not caused

by this partial paralysis, but depended upon the condition of irritation in the vestibule.

SECOND CASE.—*Affection of the organ of hearing, presenting the symptoms of so-called Ménière's disease. Deafness of the right ear. Permanent deafness as regards the lower tones. Return of the perceptivity for the high tones. Partial return of the perception of speech.*

Mr. M., aged 54, a government official, consulted me on July 10, 1871. He stated that he had always enjoyed good hearing, and that with his left ear he still heard very well. The latter statement was not borne out by the examination. During the past few years the patient had noticed a gradual diminution of hearing of the right ear, without, however, being annoyed by any particular subjective sensations. For this affection of the right ear he had been treated, without success, by two physicians with the catheter and injections into the middle ear. About fifteen months ago, an intense whizzing noise, accompanied with vertigo and vomiting, appeared in the right ear, without any assignable cause. On account of these additional phenomena a third physician was consulted, who made the stomach responsible for all these symptoms, and prescribed in accordance with this view. As, however, his remedies did not produce the desired effect, the catheter was again resorted to, without better success. Every mental effort, every excitement, increased the noises and caused vertigo, with staggering from the affected side toward the sound side. Bodily exertion, *e. g.*, travelling, had the same effect. Quite recently, while making a small tour on a railway, he had an attack of vertigo, from which he recovered after two hours of rest. The changes of weather, especially the transition to rain, the beginning of winter, imminent thunderstorms, manifested their influence by an increase of the noises and a diminution of the acuity of hearing. The whizzing noises of the ear were at times changed into humming noises heard in the head. Besides the whizzing noises the patient perceived, incessantly, the beats of the pulse in the affected ear. He did not complain of palpitation of the heart.

On examination, I found the right auditory canal spacious, dry; the drumhead opaque, somewhat sunken; handle hyperæmic, middle ear accessible. No râles on auscultation. He understood loudly spoken words at a distance of 1′. The watch (hearing distance 30′) was heard at the distance of 2″ and from the temple. Tuning forks (C′ C″ A) were neither heard by conduction through the air nor through the bones of the head. By the latter conduction the tuning forks were always heard with the left ear, the acuity of hearing of which was 5′ for the watch. Perception of speech was good. The electrical examination of the right ear (15 elements, external arrangement) showed hyperæsthesia, with reversion of the formula according to Brenner:

R.E. 15 el. Ca Cl — o
Ca D — o
Ca O — Seething >
An Cl — Seething ′
An D — Seething ∞
An O — o

The subjective noises diminished in intensity during the action of the cathode, ceased completely with a current of 30 elements, and increased during the action of the anode.* After ten sittings the patient felt his head lighter, but the subjective noises, though silenced by the action of the current, always returned in a milder form. The hearing distance for speech was 12′, for the watch 5″. By conduction through the bones of the head the tuning forks were always heard on the left (healthy) side. After the tenth sitting, in the afternoon, the patient perceived whizzing noises in the forepart of the head, in the evening. This symptom generally appeared as the forerunner of an imminent attack of vertigo. The attack occurred the next morning. The patient went to bed immediately. In the afternoon he rose and sat down at the table. After having eaten some soup, he felt an inclination to vomit. He again lay down, but still vomited. "I had a sensation as if somebody pierced my brain from below upward." The vertigo

* It is remarkable that the patient, in spite of his tendency to vertigo, never became dizzy during the passage of currents of such intensity.

ceased in bed, and the patient felt comfortable as long as he lay quietly on his back, but as soon as he moved his head from right to left, or from left to right, the vertigo returned. Hearing distance 10′. Whizzing noise not materially increased. Head neither hot nor heavy. Pulse 64, vigorous. Temperature 37.1 C. Heart and aorta normal. Two days later the electrical treatment was resumed. After ten other sittings the result was as follows: Hyperæsthesia with reversion of the formula still existed. The whizzing ceased completely during the action of the cathode with a current of 30 elements. The hearing distance for speech was improved to 30′, for the watch to 9″. The result of the examination with the tuning forks was very remarkable. The vibrating tuning forks placed upon the bones of the head were still heard on the left side. The patient heard the tuning forks C′ and C″ when placed before his right ear. When I held the tuning fork A before his right ear, he said: "I do not hear A: I hear a different tone." The patient evidently heard its overtone e‴, the twelfth. The examination with the piano showed the following:—

The patient stood in an adjoining room at a distance of 24′ from the piano, with his sound ear closed; the low tones he did not hear at all; from f he heard the single tones, from f to d they appeared equal, from d he heard them more and more distinctly. The patient was discharged on August 2.

The foregoing case is also one of Ménière's disease. In this case the middle ear had been affected some time before the occurrence of the attack, which destroyed almost totally the function of the right ear. The symptoms accompanying and following the attack were those commonly found in cases of Ménière's disease. The interesting feature of the case is the return of a comparatively good perception of speech in spite of the deafness for the lower tones up to f.

In an electro-therapeutical point of view the case is remarkable.

As stated above, the patient showed, on electrical examination, Brenner's formula of so-called hyperæsthesia with reversion of the formula. I had the opportunity of corroborating Brenner's statement in different patients; and though we do not yet know what particular state of the auditory nerve this formula indicates, it is nevertheless therapeutically important to note this reaction, as the treatment of these cases with the anode invariably aggravates the disease.

THIRD CASE.—*Complete left-sided deafness after cerebro-spinal meningitis. Considerable diminution of the acuity of hearing of the right ear. Change of the acuity of hearing as regards the high musical tones and simultaneous oscillation of the acuity of hearing as regards the perception of speech. Hyperæsthesia of the right auditory nerve with reversion of the formula according to Brenner.*

A. S., æt. 14, suffered with croup when he was six years of age, and was successfully operated upon by tracheotomy. Until March 8, 1871, he had enjoyed good health. On that day he came home from school very much excited, and stated that he had suffered a great wrong. He did not eat his dinner. In the afternoon he played in the street, with other boys, till 4 o'clock. When he entered the house he complained of vertigo and headache. A few hours later a high fever supervened. The next day the temperature rose to 41° C. The patient passed into a comatose condition unaccompanied with delirium; it was difficult to rouse him. Accidentally some boards fell to the floor near his bed; in spite of the great noise, he did not react. The change of bedclothes in the evening did not rouse him. His hands and feet were stiff. An hour later he recovered his consciousness for a few minutes, and then became again profoundly comatose. During the following 14 days and nights he lay with his eyes fixed and his head deeply pressed into the pillow in wild delirium almost continually, only having a lucid interval now and then. Rigidity of the extremities alternated with spasms. At first, vomiting occurred often, later more rarely. Bowels at times constipated.*

* I wish to inform those who do not consider this case as one of cerebro-spinal meningitis (there are undoubtedly such as would prefer to diagnosticate acute idio-

Fourteen days after the beginning of the disease the patient regained his consciousness, but was completely deaf. He could not even hear the ringing of bells close to his ear. In the fourth week he had an exacerbation of all the symptoms; the headache became very violent, and the patient cried out incessantly that there was something growing in his head. Now and then he complained of pain in his ears. The total deafness was persistent. In the fifth week the symptoms abated. In the sixth week the patient made the first attempt to leave his bed. At first he could not stand, and even many weeks later, on attempting to walk, fell on the floor. When he rose from his bed he could understand single words uttered slowly and with a loud voice. In July, the weather having been uninterruptedly warm, his condition improved somewhat. A systematic treatment with iodide of potassium gave no good result.

I examined the patient the first time on August 12, 1871. To the history of the case, as given above by the relatives, I may add, that the patient suffered on both sides from continuous, subjective noises, varying in intensity. On inquiry, the patient stated that his noises increased by external noises. The patient compared the quality of the subjective noises to the distant rolling of a cataract.

The examination of the drumheads and catheterization on both sides showed no anomaly. The left ear heard absolutely nothing; with the right ear the patient heard a watch (hearing distance 30′) at $1\frac{1}{2}''$; loud speech at 2′. There was no conduction through the bones for the watch and the tuning forks C′, C″ and A. The patient stated that, with his right ear tightly closed, he heard the vibrating tuning forks in the head, and more distinctly yet, with both ears closed. C′ he heard best, C″ less distinctly, and A least distinctly. He was not able to localize these tones correctly. Through the double otoscope the tones were conducted with equal distinctness from either side into the ear of the examiner (this examination was frequently repeated). As regards the perception of the single musical tones I found the following: The patient heard G′ faintly; B, C, D distinctly; the tones

pathic inflammation of the labyrinth) that four days later the mother of the patient became sick, showed the same symptoms, excepting those concerning the auditory apparatus, and is still suffering from paraplegia.

from D to a less distinctly, and gradually still less distinctly from a to f″; f″ was heard clearly, all the following tones to c‴ faintly; c‴ and the higher tones were not heard at all.

On examination with the constant current I found to-day and on the following days :—

RE. 12 el. Ca Cl — Diminution of the subjective noises.
Ca D — Cessation of the subjective noises.
Ca O — Seething >
An Cl — Seething′, increase of the subjective noises.
An D — Seething′ ∞ do.
An O — o Return of the subjective noises.

According to Brenner this is hyperæsthesia with reversion of the formula. The patient was henceforth treated exclusively with the cathode, which invariably caused either a diminution or a cessation of the subjective auditory sensations. After treatment the whizzing noises intermitted from one hour to several hours, but never till the next sitting. On September 15 an improvement of hearing was demonstrable; the watch was heard by conduction through the bones, and speech at 14′. The patient heard only the seven highest tones faintly even in close proximity; the other tones he heard distinctly at a distance of 24′. On September 18 the watch was not heard by conduction through the bones; speech at a distance of 16′; watch at 6″.

September 22. Watch again heard by conduction through the bones; speech at 24′. Condition unaltered. September 25. Watch heard by conduction through the bones; speech at 24′. Tuning fork on vertex heard on the right side, without closure of the right ear. All the tones of the piano heard distinctly excepting the seven highest, but these more distinctly than at the last examination. Latterly, the patient had been treated with the cathode only, and always with the above-mentioned result as regards the noises. The treatment was discontinued till October 11. The hearing distance for speech diminished to 4′. Through the bones of the head C′ was perceived faintly in the head, C″ more faintly, and A not at all. The tones of the piano were heard distinctly to g, from g up only faintly. Watch at 2″; through the bones of the head not at all. The whizzing noise

increased; the electrical formula remained the same. The treatment with the cathode was again resumed, and continued daily till October 21. On this day the examination showed the following:—Hearing distance for speech 24′; watch at 6″, and by conduction through the bones. All the tones of the piano distinctly heard, and at the same distance as before. The three tuning forks, placed on the head, were more distinctly heard than before; after closure of the ears their sounds were very loud, but the patient was still unable to refer the perceived tones to either the right or the left ear. The whizzing noise diminished.* November 25. The treatment has been suspended since four weeks. The condition of the patient was as follows: Whizzing noise increased; from d″ all the tones were faintly perceived; the tuning forks, including C″, were also very faintly heard through the bones of the head. Hearing distance for speech 2′, for the watch 1½″; no conduction through the bones.

This case is, undoubtedly, one of Cerebro-spinal Meningitis, with implication of the auditory nerves in the inflammatory process; on the left side this inflammation caused, most probably, a destruction of the nerve—by fatty degeneration, atrophy, etc.—and thus a cessation of function. An exudative process must likewise have existed on the right side. In no other way can we account for the considerable changes in the perceptivity of musical tones.

I explain the process in the following way: When the case came under my observation, the exudative inflammation in the cranial cavity had completely ceased on the right side, while it still lingered in the labyrinth. Here the process was secondary, having extended from the cranial cavity through the porus acusticus internus

* I make the examination with the piano, in the following manner: The patient is placed in a room; the piano is sounded in an adjoining room, at a distance of about 24′; the door connecting the two rooms remains half open.

as a serous inflammation, in the course of which variable quantities of exudation were at times poured out, causing an increase of intra-aural pressure of greater or less intensity.

From the researches on the mechanism of the ossicles by Dr. Burnett, we know that an increase of pressure in the labyrinth destroys, first, the perceptivity of the higher tones, and later, that of the lower tones. The history of this case shows that every disturbance of perceptivity of the higher tones was attended with a diminution of perception of speech and conduction of tones through the bones. The steady improvement of the perceptivity of the lower tones was of subordinate significance with regard to the perception of speech.

We learn from the examination of the conduction of the tones of the tuning forks through the bones, that the perceptivity of all the musical tones was impaired. As we suppose that an exudative process existed, it is not surprising that single tones of the same octave were sometimes perceived distinctly and sometimes but faintly. We can easily imagine that the inflammatory process did not invclve and change all the nervous fibres in the same manner.

The variations of conduction through the bones can be easily explained by the variations of labyrinthine pressure.

In regard to the electrical examination and treatment of the ear, I have but little to say.

Hyperæsthesia, with reversion of the formula as found in this case, has no diagnostic value. It is, however, important in a therapeutical point of view. By

the action of the anode the whizzing noise was increased; the patient, therefore, was treated with the cathode exclusively. The cathode had only a palliative effect.

If after resuming the treatment a definite result should be accomplished, I will report it.

FOURTH CASE.—*Injury of the Organ of Hearing attended with Hæmorrhage from the Nose, Mouth, and both Ears. Probable Hæmorrhage into the Labyrinth. Double-sided Deafness as regards the Upper Half of the Musical Scale. Considerable Diminution of Hearing.*

In the battle of Belfort, a soldier of the fourth Baden infantry was grazed by a bullet in the parietal region, while standing near the edge of a wall 15′ in height. He fell from the wall, head foremost, and lost his consciousness for a short time. When he recovered his senses, he bled profusely from the mouth, nose, and both auditory canals. Later, otorrhœa appeared on both sides, and the hearing became so considerably impaired that the patient could only understand speech in his immediate vicinity. He was incessantly tormented by noises in both ears.

On examination, September 17, 1871, I found the patient in the following condition:—

Both external auditory canals normal. The drumheads equally changed on both sides. They were considerably retracted, and showed cicatrices, severally of the size of a pin's head, in the posterior inferior quadrants. The cicatrices changed after the air-douche. Inflation by Politzer's method had no influence upon the acuity of hearing. (The patient stated that a physician had employed the catheter a long time without good result.)

Hearing distance 2′ for speech on either side; the ticking of the watch was not perceived by conduction through the bones. C′ and C″ were perceived through the bones of the head, but the patient was unable to localize these tones with his ears open. On closing either the right ear or the left the patient could localize them. The examin-

ation with the piano showed that at the same distance the lower half of the musical scale was perceived distinctly, the upper half not at all. The patient did not submit to treatment; he merely wished to obtain a certificate of his condition.

Aside from the traumatic laceration of the drumheads and the subsequent cicatrization, this case is characterized by a hæmorrhage into the labyrinth, and is analogous to the case which I described in the preceding number of these Archives. This hæmorrhage may have involved chiefly those nervous fibres which transmit the high musical tones. Though it must be conceded that this case is not typical on account of the co-existing changes in the drumheads, it is nevertheless important in regard to the question as to whether the perceptivity of high tones in ear patients has any bearing upon the prognosis.

Considering that the injury had existed eight months, it seemed to me very improbable that an improvement would take place.

In the following cases no musical tones were heard. Hearing was completely abolished.

FIFTH CASE.—*Meningitis—Deafness as regards all the Musical Tones—Permanent total Deafness.*

E. G., aged 12, brought me the following history written by Dr. Janser:—

"The daughter of Mr. G. was attacked two months ago with high fever, violent headache, pain and stiffness in the nape of the neck, great restlessness and vomiting. On the evening of the first day of the disease the temperature in the axilla was 39.5°C.; the pulse 110. Leeches were immediately applied to both mastoid processes; $\frac{1}{12}$ gr.

of calomel was given every two hours and cold applications were incessantly made to the head. During the following four days the patient was comatose, sighed very much, tossed violently in bed. On the seventh day the temperature fell to 38°C.; consciousness returned, but the stiffness and pain in the nape of the neck, and the headache, continued. When the fever had abated, the calomel was discontinued, indifferent infusions were administered, a blister was applied to the nape of the neck, and the surface kept open a long time. When the consciousness of the child had returned, it became quite evident that her hearing had become considerably impaired by the disease."

The administration of iodide of potassium, the application of the constant current gave no good result. No formula was found. The patient stated that during the passage of the current she heard a whistle in her head.

SIXTH CASE.—*Complete double-sided Deafness, depending upon Various Causes:—Syphilis, Rheumatism, and Concussion of the Organ of Hearing by Shooting—Complete Deafness as Regards all the Tones of the Musical Scale—Paradoxical Reaction according to Brenner.*

E. E., of London, consulted me on September 18, 1871. The patient was a merchant, and 47 years of age. In his family there is no hereditary tendency to diseases of the ear. He stated that he had suffered from secondary syphilis from 1841 till 1851, and that in later years he had caught cold repeatedly on his voyages to Sweden. In consequence of these exposures he suffered from chronic coryza, pain and swelling of various joints. The physicians could not agree as to the nature of the articular affection. When I examined him he had a considerable swelling of the left knee and a smaller swelling of the right wrist. These swellings were neither spontaneously painful nor tender on pressure.

In regard to the duration of the aural affection the patient stated that his hearing, especially on the left side, had not been normal for a long time. He suffered a material impairment of hearing in 1870, when he unexpectedly found himself on a square on which guns were fired in honor of the birthday of the queen. Four months ago he still could follow the conversation with a single person in close vicinity.

Since three months he has lost his hearing completely without an assignable cause. He was treated with injections into the middle ear; iodide of potassium was administered. The patient never had otorrhœa; he never suffered pain in his ears. He complained of continuous subjective noises of various kinds. "On the right side the noise resembles, sometimes the rolling of a wagon over a badly paved street, sometimes the noise of a regularly working steam engine, sometimes the drumming of military music, and on the left side it is either like the quick ringing of little bells or the singing of a canary-bird. I often asked my wife whether a canary-bird was in the room."

On examination I found both auditory canals and drumheads normal; the tubes permeable. The hearing was completely abolished for speech, watch, and musical tones. Through the double otoscope the tones of the tuning forks vibrating on the bones of the head were heard with equal distinctness on either side. The patient still heard the beats of a metronome at 2′ with his right ear, at 5, with his left ear.

With the constant current (12 Siemens-Halske's elements) I found the so-called paradoxical reaction of Brenner on both sides. The patient described the subjective auditory sensations produced by the current, as resembling the sounds of a child's trumpet. The constant current was applied for two weeks without producing an effect either upon the deafness or the subjective noises.

SEVENTH CASE. — *Early Impairment of Hearing by double-sided Otorrhœa.—Subsequent Complete Deafness in consequence of Repeated Attacks of so-called Ménière's Disease. — Paradoxical Reaction.*

Mr. R. suffered in early infancy from scarlet fever. In the course of this disease he was attacked with pain in his ears, followed by otorrhœa, of which he still suffers. His hearing became impaired. Six years ago it was still sufficiently good to enable him to follow, without difficulty, every conversation in close vicinity. Without an assignable cause he was at that time suddenly attacked with vertigo and vomiting. These attacks recurred several times, the last time in January, 1871. Every attack diminished his hearing, the last destroyed it completely.

On examination, both drumheads appear sunken, greyish red, and

thickened,—the short processes only are distinctly visible. The drum-heads are slightly covered with pus, either having a perforation of the size of a pin's head in its postero-superior quadrant. The functional examination showed the same condition as in the preceding case.

The paradoxical reaction of both auditory nerves appeared with six elements. The air-douche showed the middle ear permeable on both sides but produced no effect upon the hearing. I did not treat this patient.

In considering the facts observed in the first four cases we find that, upon the whole, they correspond with our knowledge of the significance of the higher musical tones in relation to the perception of speech.

The examination was made with a piano of seven octaves. The human speech comprises eight octaves.* The higher tones appear of greater importance for the understanding of speech than the lower tones. This observation corresponds with the physiological facts as regards the pitch of the single vowels and consonants of which the human speech is composed.†

Aside from their diagnostic value, the cases reported in this paper, are of interest to the aurist in regard to prognosis. In many cases of so-called "nervous affection of the ear," the question as to whether the patient perceives the higher musical tones distinctly, faintly, or

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* "The limits of human speech are in a certain degree arithmetically definable; R, with 16 vibrations in a second, being the deepest tone, and S, with 4032 vibrations, the highest. The lowest tone of speech is musically expressed by subcontra C, —C or C^2, its highest approximatively by c^v. Speech thus comprises 8 octaves."—Oscar Wolf. Sprache und Ohr. p. 72.

† See Helmholtz. Die Lehre von den Tonempfindungen. 3 Ausgabe; and Wolf, l. c.

not at all, may furnish us with a clue as to the probable degree of recovery of hearing.

On observing additional cases we may be enabled to define the exact limit at which we can dispense with the low tones without noticing an impairment of the perception of speech.

ON THE CHANGES IN THE RETINA AND LABYRINTH IN A CASE OF FIBRO-SARCOMA OF THE AUDITORY NERVE.

By Prof. ARTHUR BOETTCHER, of Dorpat.

(With Plates I. & II.)

[(Translated from the German by Dr. Charles J. Kipp, of Newark, N. J.)

The following case of tumor of the brain, with consecutive blindness and loss of hearing, with perverse perception of taste, and other functional disturbances of which I shall not here speak, is by no means an uncommon one; but so closely resembles several cases already published that it might almost be identified with them. Whilst the fact that hearing and vision suffer or are entirely destroyed during the growth of such tumors is generally known, the anatomical changes occurring in both nerves of special sense are as yet not clearly understood. Concerning the affection in the retina, which has of late been repeatedly observed in the living with the ophthalmoscope, we find that the statements of the morbid changes differ greatly; whereas the minute changes in the labyrinth have heretofore entirely escaped investigation.

I would not, therefore, let this opportunity pass without inquiring into the conditions on which the disturbances of sight and hearing depend. The results obtained with regard to the former differ in many points from those of my predecessors; and with reference to the latter, I may say that this communication forms the beginning of a pathological histology of the cochlea. Having premised the above to elicit the interest of the reader for my observations, I shall now proceed to the description of the case. The patient was under the care of Prof. von Oettingen, who has kindly furnished me with the following history:—

Chr. Levinson, a Jewess, 21 years of age, of medium stature and slender form, but with well-developed muscles, was admitted to the Ophthalmic Hospital on the 18th of November, 1870.

The eyes were staring; the functions of the ocular muscles were, however, normal. Both eyes were totally blind; the pupils were dilated ad maximum, and responded only moderately to light. The facial nerve of left side was paralyzed in all its ramifications; the lower half of scleral conjunctiva was hyperæmic and the corresponding portion of cornea superficially inflamed, in consequence of incomplete closure of lids. The tongue was protruded in a straight line. The uvula and soft palate were in their normal positions. There was complete deafness of left ear. It is not known whether there were subjective sensations of sound. The hearing of right ear seemed also impaired, but as on examination it was found that the hearing distance was but slightly shortened, it seems probable that this was due to a certain dulness of the psychical functions. No organic change in organs of hearing could be demonstrated. An extremely tormenting headache, more especially of left side, was almost constantly present; and there was intercurrent pain in ramifications of sensitive branches of fifth pair of left side. The integument was equally sensitive on both sides of face. Patient complained especially of a bitter taste and a burning sensation in mouth;

also of difficulty in swallowing and loss of appetite. The sensibility and the mobility appeared to be unimpaired on either side of the body; at request, movements of separate limbs were executed without hesitation, but the faculty to combine movements for a definite purpose was impaired in a high degree. When trying to walk alone she reeled so much that she was in danger of falling if not supported, and the lower extremities moved totteringly. The palpation of the head and spine disclosed nothing abnormal, and no point of special tenderness on the former could be discovered by percussion.

The ophthalmoscope revealed nearly the same appearances in both eyes; the refracting media clear, with the exception of a part of left cornea (see above). The optic papilla markedly white and without a definite boundary; the surrounding retina being of the same color and infiltrated in a concentric ring, the diameter of which was about three times that of the optic papilla. The level of optic nerve entrance was somewhat raised; the retinal vessels, as far as the infiltration went, were here and there covered. The veins were very tortuous, even to a greater distance; the arteries were but little changed.

Excepting a slowness in answering, the psychical functions had not suffered. Patient had been constipated for nine days, and had unmistakable symptoms of a chronic gastric catarrh. The menses had been suppressed for a year. The functions of the other internal organs were all well performed. The secretion of urine was also normal, but its evacuation was difficult and somewhat slow. Pulse and temperature were normal.

The patient's parents were both healthy, and she herself had enjoyed good health until her 19th year. Two years ago she was attacked with severe headache and vomiting without any assignable cause, and since that time she has repeatedly suffered from similar attacks. Once she took a severe cold and at the same time had a violent fit of anger; on the following morning she awoke with great headache, blindness and deafness on the left side, and swelling and distortion of left half of face. At the same time she felt a weakness of left side. While these phenomena persisted, the *right* eye likewise became gradually blind. Five months ago she resorted to sulphur baths, but without benefit. Since that time there has been no return of the menses, and twitchings have been observed from time to time in the *right* arm.

There could be no doubt that this was an intra-cranial affection, and it could as little be doubted that its seat was mainly on the left side of the basis cranii; that the pathological product was in the posterior or middle fossa of the cranium, and suspended the functions of the facial and auditory nerves, at the same time irritating the trifacial, and perhaps the glosso-pharyngeal and pneumogastric nerves, if the symptoms above mentioned were not exclusively due to the gastric catarrh. It was more difficult to explain the participation of the tracts of the optic nerves, as they are situated more distantly in the anterior portion of the middle fossa. The opthalmoscopic appearances pointed toward a neuritis optici descendens, lacking the characteristic features of the choked papilla, dependent on an intra-cranial tumor, and consequent increase of intra-cranial pressure. Lastly, there could be no doubt that the cerebellum and, perhaps, the pons Varolii, suffered likewise from the disease. Extremely difficult, on the other hand, was the definition of the nature of the pathological process. Experience would lead us to the diagnosis of a pseudoplasm, which by its steady growth on the base of the skull, produced the symptom above mentioned. But this diagnosis was not strengthened by the history of the case, according to which essential symptoms of paralysis had appeared suddenly over night. We therefore thought that we had possibly to deal with an intra-cranial extravasation, which had caused the inflammatory processes at the base of the skull and in the neighboring nervous parts. This supposition had to be kept in view the more, as it

held out at least some hope of benefit from treatment.

The subsequent history of the case up to the time of death, April 3, and the treatment adopted, were briefly as follows: The gastric catarrh was relieved by a careful diet, the irregularities of the digestion by the use of soda-water, rhubarb, extract of colocynth, and clysmata, whilst intercurrent attacks of diarrhœa yielded best to the administration of tannin. By the use of hot footbaths and sinapisms we succeeded in bringing on the menses. Inunctions of ungt. hydrarg., after Sigmund's method, were ordered, and a seton applied to the back of the neck. During this treatment, which was well borne, and completed without the occurrence of salivation, the application of an ice-bladder to the head was found to be the only means of relieving the headache. The inunction treatment was concluded November 20, after thirty inunctions of 3 j had been made. On some days during this treatment the patient was in a somewhat more comfortable condition; but this was entirely due to the mitigation of the headache and indigestion. In the mean time the symptoms of irritation increased, the headache became severer, and vomiting, transient epileptical convulsions and increased temperature were observed. Some relief was obtained from the application of leeches to the mastoid process. After the completion of the inunction treatment, iodide of potassium was given for two weeks, but no improvement followed; nor were the symptoms of irritation mitigated by the use of the bromide of potassium; and the hydrate of chloral had as little effect on the insomnia.

In the early part of January we observed with the ophthalmoscope increased swelling of the disc, and also found that the infiltration in the adjacent retina had extended, although it still was circumscribed; but no trace of retinal extravasation could be observed.

Considering the utter inefficiency of the treatment pursued, and the progress of all the symptoms, it was now quite clear that we were dealing with a tumor at the base of the brain. From that time the treatment was entirely symptomatic. The superficial keratitis improved somewhat under the use of astringent collyria and the bandage. About the end of March, the above-mentioned phenomena of increased cerebral irritation became constant and more violent.

Shortly after a severe attack of vomiting there was a complete cessation of respiration and pulsation, with total unconsciousness; but this attack, the cause of which could not be ascertained, soon passed over. On the first of April, the patient was attacked with facial erysipelas, accompanied with albuminuria and great elevation of bodily temperature. Coma soon supervened, and death occurred on the third of April, while the erysipelas was at its height.

Autopsy.—Exactly twenty-four hours after death, I made a post-mortem examination, the results of which were in substance as follows:—

Body well nourished, rigor mortis marked, integument remarkably pale; but few suggillations on the back. Adipose tissue abundant, especially in abdominal walls; muscles dark and dry.

Face bloated, especially lids of left eye greatly infiltrated.

The moderately thick skull-cap of compact structure; in the os frontis, exactly in the median line, was a depression of the size of a pea, which almost perforated the bone, caused by a Pacchionian granulation. In its posterior part the skull seemed unsymmetrical, as the part corresponding to the right crus of the lambdoid suture appeared somewhat flatter than that opposite; but the suture itself was well preserved in that place.*

The longitudinal sinus contained dark fluid blood, but no coagula. The dura mater thin and tense, but injected. The soft membrane frail and likewise tense;

* In view of the fact that the suture was wholly preserved, and that a tumor was found within the skull posteriorly and to the left, which, judging from the history of the case, had been growing for about two years, the want of symmetry should not be referred to a flattening of the right side, but rather to a gradual elevation of the left, the result of intra-cranial pressure.

its veins were moderately filled. The convolutions of cerebrum were greatly flattened, especially on both sides of the longitudinal sinus. After the removal of the brain, more than an ounce of serum was found in the posterior fossa of the skull. At the base, the finer vessels of the pia mater were more injected. Below the bulging tentorium, and immediately to the left of the pons, was seated a tumor the size of a small apple, which lay against the posterior surface of the petrous bone, and extended into the porus acusticus int., at the entrance of which it had to be severed. In its general outline it was nearly spherical, yet at the same time somewhat nodular; it appeared to be covered by a continuation of the pia mater. On the cut surface it showed a white coloration, a scanty amount of blood, and a fleshy consistence throughout. When pressed upon it yielded a quantity of clear, somewhat sanguinolent fluid. Its largest diameter measured 4.5 cm.; its smallest, 4 cm.

This tumor was so seated between the pons and the medulla oblongata on one side, and the left hemisphere of the cerebellum on the other, that one-half of it appeared surrounded by the brain, whilst the other half projected freely downward. Where its inner surface was in contact with the pons, the pons was flattened laterally, and its left half was greatly atrophied. In consequence of this, its longitudinal groove (sulcus basilaris) did not coincide with the median line, but was nearer to its left edge, and resumed its usual position only in the posterior portion of the pons. By this the pons had gained in length at the point of compression,

and at this point its posterior lower edge was farther depressed (Fig. 1, Table I.). The medulla oblongata had taken an oblique position, was displaced to the right and showed two unsymmetrical halves. Very conspicuous was the great projection of the left olive, whilst the right was slender and thin.

At its outer and posterior surface the tumor was embraced by the left hemisphere of the cerebellum, into which it had dug a semilunar cavity. The flocculus and the greater part of the tonsilla had been destroyed, and the adjoining parts of the other lobes had been excavated by the tumor; of the tonsilla only the most posterior and superior part was preserved, but greatly crowded upward. The floor of the cavity in which the tumor was situated, was formed by the crura cerebelli, which seemed greatly enlarged and stretched outward. The wall of the entire cavity was smooth and lined by the pia mater; between it and the tumor were found only a few communicating vessels with delicate cords of connective tissue, so that it could be easily and completely detached.

Upon closer examination, made in part after the preparation had been hardened in alcohol, it was found that the common trunk of the auditory and facial nerves, from the point where it appeared behind the pons, was contracted into a thin cord, more than 2 cm. long, which was inserted into the inner surface of the anterior portion of the tumor (Fig. 1, Table I.). To the unaided eye, this cord appears composed of several fine threads. Diagonally opposite, in an outward and forward direction, was the point at which the tumor, at its

entrance into the porus acusticus int., had been divided. The root of the trifacial nerve, which at the autopsy was found to be totally compressed, could not be demonstrated in the hardened preparation. Unfortunately, no examination was made of the nerve in its further course in the body.

The fibres of the trochlear nerve presented no alteration under the microscope. The glosso-pharyngeal and pneumogastric nerves were compressed by the tumor; their roots were proportionately thin, and had undergone fatty degeneration to a considerable extent. Of the microscopical characteristics of the auditory and facial nerves, I shall speak further on: those of the hypoglossal nerve were unaltered.

The fourth ventricle was dilated, its ependyma was uniformly thickened, and the elevations and depressions of the brain substance beneath it were completely leveled; the striæ medullares had disappeared entirely; the corpora restiforma were atrophied, and the calamus scriptorius was transformed into a simple funnel. Both olivary bodies, but more especially that of the left side, were transformed into broad pouches; the velum medullare, with the lingula, was atrophied; the aquæductus Sylvii, compressed. The crura cerebelli were flattened correspondingly with the dilatation of the fourth ventricle; those of the right side were of a more roundish form and measured 2 cm. in an oblique direction (antero-posteriorly); but on the left side the crura cerebelli ad pontem, ad corpora quadrigemina, and ad medullam oblongatam had been transformed into a completely flat cord, 3 cm. broad, which, as was

above stated, was also seen from below, covering the tumor.

The third ventricle was likewise greatly dilated, its floor was broad and gaping; the tuber cinereum was especially dilated, in consequence of which the floor of the cavity was so much displaced forward and laterally that it occupied almost the entire breadth of the chiasma nerv. opt., and had somewhat flattened its upper surface.

The lateral ventricles were no less dilated, and the left, principally its posterior horn, was still more enlarged; each of these contained about an ounce of serum. The fornix and septum pellucidum were firm and tenacious; the vessels of the choroid plexus were moderately filled; the ependyma was uniformly smooth and shining. The corpora striata and thalami optici were anæmic and relaxed, and the depression between them, together with the tænia semicircularis, were effaced; the pineal gland contained some chalk; the corpora quadrigemina were pale and flabby.

The white matter of the cerebrum was somewhat hyperæmic, but likewise flabby; the cortical layer, very thin at some points, was slightly injected.

The lungs contained air in every part; hypostatic hyperæmia was found in their lower and posterior portions; the left was strongly adherent to the wall of the chest.

The moderately large heart contained much dark fluid blood, with œdematous lardaceous coagula in the right ventricle. The edges of the mitral valve were thickened. The muscular tissue firm; that of the left

side of a brownish red color. The calibre of aorta was narrow.

With regard to the abdominal organs I will only mention, that the stomach presented the signs of a very severe chronic catarrh which, as it extended into the ilium, gradually diminished in severity. On the outer surface of the lower third of the duodenum was found a fibrous tumor of the size of a hazel-nut, which had caused a funnel-shaped retraction of the inner surface of the intestine. The liver was moderately congested, and the spleen somewhat enlarged by recent swelling. The kidneys were hyperæmic, the ovaries large, and their surfaces studded with numerous follicles, part of which were hydropical.

*Examination of the Optic Nerves, the Chiasm and the Retina.**—On examination of the trunks of the optic nerves, their intraorbital portions appeared unaltered to the naked eye; but there was a conspicuous thickening of their outer sheaths,† which at different points measured 0.65 mm., 0.75 mm. and 0.9 mm. The subvaginal space (Schwalbe) was enlarged. The optic nerve was therefore but loosely invested by its outer sheath.

The microscope showed no pathological change of any importance in the nerve fibres. What alone seemed worth mentioning was a certain pallor of the fascicles nearest to the inner sheath, when examined by transmit-

* Previous to the examination, the preparation had been lying for three weeks in Müller's fluid, and subsequently for a few days in alcohol. Only the posterior segments of the eyeballs had been removed from the body.

† The normal thickness of the outer sheath of the optic nerve is stated to be 0.5 mm. (Henle).

ted light, although a distinct marginal zone could not be discovered by the unaided eye. This pallor was due to atrophy of the medullary sheaths of the nerves. The number and the extent of the portions thus affected were however so small, that they would probably have entirely escaped observation if the same process, but in a much higher degree, had not been found in the more central portions of the optic nerve.

To guard against overlooking slighter alterations I treated transverse and longitudinal sections with different reagents. By steeping the preparation in chloride of gold, the bundles of nervous fibres were intensely colored. The axis cylinders were made plainly visible by carmine, and the number and the arrangement of the nuclei in the interstitial connective tissue were examined with aniline, which renders the nuclei very visible. The presence of amyloid bodies was tested with iodine and sulphuric acid. The result of all these examinations was negative, no pathological products (granular bodies, proliferation of nuclei, corpuscula amylacea) nor changes in the appearance of the nervous fibres being recognizable, if we except the trifling affections above mentioned.

But a different condition was found in the chiasm and the first portions of the optic nerves.

As stated in the report of the autopsy, the chiasma was slightly compressed at its upper surface, and the adjacent portions of the optic nerves were somewhat flatter than usual. Corresponding with this, there was seen on the upper surface, where the flattening had occurred, a fine transparent stripe, plainly visible to the

naked eye, in transverse sections of the hardened preparation (Fig. 2 A, b, Tab. I.). At this place the nerve fibres had disappeared and in their stead was seen a delicate connective tissue, transverse sections of which showed a fine network (Fig. 2 B a), interspersed with nuclei (B c and C b), and connected with the sheath.

From this network similar transparent filaments, growing gradually thinner, radiated in all directions of the transverse section, between the bundles of the dark-bordered nerve fibres. In addition to this, there was seen around the entire periphery, immediately below the inner sheath, a narrow zone, in which the optic nerves were degenerated in a similar manner.

In these places (which, as is well known, are of a gray color in the fresh state) were everywhere found numerous corpuscula amylacea, which became intensely blue by iodine and sulphuric acid. In the dark portions of the transverse section, where the nerve fibres were still recognizable and opaque (Fig. 2 A c), great quantities of granular bodies were seen scattered amongst the nervous fibres, with but proportionally few amyloid bodies.

The morbid process was therefore very marked in the chiasma, but extended, gradually diminishing, only 0.5 cm. along the optic nerve. At this point the amyloid and granular bodies disappeared, but at the boundary of the morbid process the medullary sheaths of the nerve fibres showed a finely granular fatty degeneration, the nature of which could not be determined in the hardened preparation.

A propagation of the morbid process in the cranial

cavity to the retina did not, it seems to me, take place, as the only alteration found in the optic nerve was the circumscribed atrophy at the periphery above mentioned.

Alterations of more importance began to appear at the lamina cribrosa. In longitudinal sections of the optic nerves which passed through the papilla, a very great dilatation of the subvaginal space was very conspicuous. Its blind end was distended like a bag, and its retiform connective tissue framework unusually developed. The trabeculæ of the lamina cribrosa also appeared thicker, and their sections more distinctly striated than usual; it was, however, very difficult to say whether any of the nervous fibres were atrophied or totally destroyed. A part of the nervous fibres could be distinctly seen passing through the lamina cribrosa into the papilla. From the thickness and the close aggregation of the transverse connective tissue fascicles in the lamina cribrosa, I think that the nervous fibres entered the eye in a smaller quantity than in the physiological condition. The changes in the papilla nervi optici were more marked. The papilla was considerably raised, a section passing through its centre projecting on one side 0.85 mm., and on the opposite side 0.95 mm. above the choroidal foramen, without sloping abruptly towards the level of the retina. The central excavation was funnel-shaped and comparatively deep, but did not reach the level of the choroid.

The central vessels of the papilla divided into a greater number of branches before they reached the bottom of the funnel. Their walls were thickened, and both in trans-

verse and longitudinal sections they were surrounded by a gaping light space, which I can take only for a dilated lymphatic sheath; around this was a dense mesh of fibrillæ, filling, as it were, the intervals between the vessels. In these fibrillæ, running in various directions, there were embedded numerous nuclei, principally at the bottom of the central excavation, where the retinal vessels divide. But at the prominent points of the papilla I sought in vain for the parallel lines of nervous fibres proceeding in a definite direction; in their place there was a delicate network of interlacing fibres. I therefore think that I am not mistaken in asserting that the superficial layer of the optic papilla was mainly composed of proliferating interstitial connective tissue, accompanying the blood-vessels. Only in the deeper layers of the papilla were found parallel fascicles of fibres bending over into the retina; of the relations of which to the remaining layer of the retina I shall speak hereafter. But first I may mention that no distinct boundary existed between the apparently thickened connective-tissue layers and the fibrous tracts (nervous fibres?) bending over into the retina. I obtained no decisive results from staining longitudinal sections of the optic nerve with chloride of gold.

The retina* showed a marked thickening round the optic disk. At a distance of about 1 mm. from the disk, the retina† still measured 0.6 mm. in thickness, but soon

* The following description of the changes in the retina is based exclusively on the examination of the left eye, as on comparison it was found that those of the right were essentially the same.

† Accordin to Henle, the thickness of the retina in a normal eye, at the disk, measures 0.3—0.4 mm., and 2 mm. further on, only 0.2mm. (Eingeweidelehre, p. 637.)

became so attenuated that 3 mm. farther towards the equator its transverse diameter was only 0.3 mm. (Fig. 3.) The arrangement of the different layers of the retina will be spoken of after the more conspicuous alterations have been described.

In the first place was to be mentioned the extraordinary development of the radial fibres, which appeared exceedingly thick and shining, having enlarged, markedly striated ends, some of which contained nuclei.

Most of these did not insert themselves into the limitans interna, but communicated with one another, forming strong arches, which caused an apparent increase of the thickness of the limiting membrane. (Fig. 4.) This excessive development was visible not only at their inner ends, but in their course through the outer layers of the retina. These fibres were most conspicuous in the immediate neighborhood of the optic disk, where the retina was thickest. Transverse sections of this region discovered at once the entire course of the radial fibres from the inner limiting membranes to the outer. The boundaries of the layers of the retina were there effaced, the two granular layers principally, had coalesced, and under low powers showed a radiating striation, resulting from the strongly marked transverse fibres. (Fig. 3 k.) This condition was no longer observed a short distance from the papilla (Fig. 3), when the different layers of the retina could be clearly distinguished, and showed the following alterations:

1. The layer of nervous fibres did not reach the inner limiting membrane, but was separated from it by an appreciable space (on an average 0.03 mm.). In

the section parallel to the fibrous layer a radiating striation was seen (Fig. 3 a), in which the broadened ends of the supporting fibres could be recognized with the higher powers. Sections at right angles to the fibre bundles (Fig. 5) showed the same striation, and, besides, a space which lay between the inner limiting membrane and the nervous bundles; this was bounded by the arches of the thickened radial fibres, and was either empty or wholly or partially filled with a very finely-granular substance (Fig. 4*b*). This substance had the appearance of a spongy coagulum of an albuminous fluid; an examination with reagents was impracticable, on account of its small quantity.

Henle and Merkel* observed similar gaps between the inner limiting membrane and the layer of nervous fibres in the sheep, and interpreted them as lymphatic spaces; Dr. Rosenberg informs me he has occasionally observed them in animals killed by strangulation. This observation strongly supports the assumption that the increased intra-cranial pressure fills a lymphatic space of the retina, and that the very same cause, the existence of which was proved by the autopsy, had separated the layer of nervous fibres from the inner limiting membrane in this pathological specimen. A comparison of my preparations with those of Dr. Rosenberg and with the drawings given by Henle and Merkel shows that they differ in this, that in my preparations the ends of the supporting fibres are more coalescent, and form rather thick arches, from which the

* Zeitschrift für Rat. Med., Vol. 34, p. 62, Tab. iv., Fig. 11 and 12.

nervous fibres are more remote. The long duration of the morbid process (the augmented intra-cranial pressure) must doubtless be taken into consideration. This morbid process seems to have had some influence on the nervous fibres. I measured many nervous fibre bundles, and found their sections 0.01, 0.02, 0.03 mm. by 0.02, 0.03 mm.; but a great many of them were round, having a diameter of 0.01, 0.02 mm. If we compare with this the examinations of Henle, who states their width at 0.025 mm. and their height at 0.015 mm., it seems indeed that in our case the size had been diminished.

From a merely anatomical examination of longitudinal (Fig. 3 *b*) as well as transverse sections (Fig. 4 *c*) of the layer of parallel bundles, we must nevertheless assume that the greater part of the nerve fibres had been preserved. An entirely different result was obtained from staining with chloride of gold. That which appeared to be a layer of nervous fibres was absolutely not stained by this reagent, neither were the two granular layers affected by it; whereas both the molecular layers above all, and often alone, reduced the gold; and besides these, in other preparations the outer layer of fibres (inter-granular layer), and the cones of the bacillar layer were also stained intensely violet. From this is to be inferred that no nervous elements were represented in the fibre fascicles of the original nervous fibre layer, or that their number was so small that they could not be recognized by their color.

The same negative result was obtained from the chloride of gold treatment of the layer of nervous fibres in

the vicinity of the papilla (Fig. 3 b'), where its thickness, instead of 0.6 mm. in the physiological condition, measured only 0.2 mm. From an anatomical point of view we also could not fail to recognize here, in the vicinity of the blood-vessels (Fig. 3 v), which were provided with perivascular lymphatic spaces, reticulated, interlacing strata of proliferating connective tissue, merging gradually and without distinct boundary into the tracts of parallel fibres.

2. The ganglionic layer. In its stead only lacunæ were seen almost everywhere (Fig. 3 c, Fig. 5). Only after prolonged searching was I able to detect a few well-preserved multipolar cells. In the region of the yellow spot, however, I found some arranged in a row, and even two above each other. But the atrophy of this layer was doubtless nearly a complete one.

3. The granular layers, in which the thickening of the retina was most marked, and the bacillar layer were distinguished by perfect preservation of their elementary parts. A noteworthy change in the neighborhood of the papilla was, as above stated, the continuance of the thickened radial fibres from the inner limiting membrane to the outer, which determined the arrangement of the granules. The transverse striation resulting therefrom was especially marked in the inner granular layer (Fig. 3 *k*). Between the columns of radiating fibres, at pretty regular intervals, were seen lacunæ which made the impression upon me that the structural elements had been crowded apart by serous exudation (œdema.) In the places where no lacunæ were the granules appeared much more sparsely strown, which made the whole

layer, by transmitted light, appear greatly lighter than usual. This condition disappeared at some distance from the papilla (Fig. 3 *e*).

4. The outer fibrous layer (inter-granular layer) was, as usual, of varying thickness (Fig. 3 *f*, Fig. 5 *f*), and entirely absent in the places near the papilla, just described (Fig. 3 *k*). There the outer molecular layer was likewise absent, whereas the inner was preserved (Fig. 3 *d'*), but less distinctly bounded, and changed in appearance by the thickened radial fibres.

5. The rods and cones were everywhere well preserved.

In conclusion, I beg leave to add a summary of the relations of the different layers of the retina to each other, according to the section represented in Fig. 3.

The following are the measurements of the different layers at a distance of 1 mm. from the papilla:—

The layer of nerve fibres	0.2 mm.	(Fig. 3 *b'*)
The inner molecular layer	0.03 mm.	" *d'*)
The coalesced granular layer	0.32 mm.	" *k*)
The bacillar layers	0.05 mm.	" *i*)
Thickness of retina	0.6 mm.	

At a point 3 mm. distant from the papilla we found:—

The distance between the membr. limit. int. and the layer of nerve fibres	0.03 mm.	(Fig. 3 *a*)
The layer of nerve fibres	0.03 mm.	" *b*)
The ganglionic layer	0.015 mm.	" *c*)
The inner molecular layer	0.03 mm.	" *d*)
The inner granular layer	0.07 mm.	" *e*)
The outer fibrous layer (inter-granular layer)	0.015 mm.	" *f*)

The outer granular layer	0.06 mm.	Fig. *g*)
The bacillar layer	0.05 mm.	" *i*)
Thickness of retina	0.3 mm.	

The regions of the retina in which the larger vessels ramify deserve a more special consideration. They were in general characterized by greater thickening than the surroundings. At the same time it was observed that the retina, after having been hardened and detached, had lost its uniform curvature on its outer surface along the course of the blood-vessels, where it presented a fold-like elevation, best seen in a transverse section (Fig. 5). Here the following changes had taken place:—

The larger vessels provided with a thick muscular coat (arteries) showed a light perivascular space, around which were concentric layers of fibrous connective tissue, the more external portions of which were gradually lost in the layers of the retina. Here the layer of nervous fibres was so greatly thickened that it measured more than half the diameter of the entire retina; the membr. limit. appeared raised in irregular nodules on the inner surface, whilst in an outward direction the morbid process extended deeply into the inner granular layer. The ganglionic and the inner molecular layers were absent in the immediate vicinity of the vessels. The radial fibres were uncommonly coarse and could readily be traced into the outer intergranular layer; there was, however, not the slightest regularity in their arrangement; they curved around the vessels and consequently appeared widely separated at one point, whilst they were closely pressed together at another. At the same

time each separate fibre was visible without interruption from its broadened end onward. Between them, the thickened layer of nerve fibres extended close up to the inner limiting membrane (Fig. 5), and was, therefore, not separated from the latter by a lymphatic space in the immediate vicinity of the blood-vessels. But this space became visible again on both sides a short distance from the vessels, where the radial fibres had a more regular arrangement, and the thickening of the layer of nervous fibres decreased; this decrease was so uniform on both sides that the diameter of the retina, which in the course of the vessels was augmented to 0.6 mm., sunk to 0.3 mm. at a distance of 3 mm. from the blood-vessels. (Fig. 5.)

What was the composition of these thickened strata of fibrous tissue surrounding the retinal vessels? Their arrangement was that of parallel bundles, a transverse section of which had the same appearance as that of normal fascicles. Chloride of gold produced no staining. The supposition of a numerical hyperplasia of nervous fibres could therefore not be substantiated, although the fibres in the thickened parts did not differ in their aspect from those of the normal thin layers. On the other hand it may be stated that on account of the negative reaction with the chloride of gold, the fibres of the thin layer also were degenerated.

With a view of arriving at a more exact decision in regard to the surroundings of the vessels, than is possible to form from transverse sections, I made surface sections of the retina, which were carried through the thick ridge extending along the vessels. They

showed very plainly that the bloodvessels were embedded in a thick layer of wavy, rigid, shining connective tissue fibres, arranged in bundles, between which were lacunæ containing round granulated nuclei, grouped either in rows or clusters. A hypertrophy of the nerve fibres was therefore entirely out of the question; on the contrary, the entire thickening of the fibrous layer and the surroundings of the blood-vessels was due to a proliferation of connective tissue.

Critical remarks on the above-described disturbances of vision.

From the preceding description it appears that with regard to the loss of vision, occurring in our case, two different centres of disease were found, which must be strictly kept apart. These are:—

1. The atrophy in the chiasma and the roots of the optic nerves, produced by pressure of the tuber cinereum, swollen in the shape of a bladder. In the superior portion of the former was found a localized gray degeneration, and in the deeper parts was observed a considerable quantity of granular bodies amongst the partly conserved nervous fibes.

Türck* was the first to call attention to an affection of the same nature in the chiasma, caused by dilatation of the third ventricle in hydrocephalus; a more precise determination of the conditions leading in this way to amaurosis is, however, still needed. Not every case of hydrocephalus with great intra-cranial pressure produces

* Zeitschrift der Wiener Gesellschaft der Aerzte. 8. Jahrgang, 1852, p. 300.

a protrusion of the tuber cinereum, nor does blindness occur in every severe case of hydrocephalus internus.

From an analysis of my case with regard to this point, it appears to me to be of importance with reference to the dilatation of the third ventricle and the conditions resulting therefrom, to notice (as I have previously more particularly explained) that the tumor had caused a compression of the aquæductus Sylvii; and had also completely or partially obstructed the three anterior ventricles. In this condition the accumulating contents of the ventricles could probably not find an outlet, and an increase of pressure be obviated by a distribution of the fluid. We can at least not reject the supposition that probably only under certain conditions, similar to the above, an affection of the chiasma results from the protrusion of the tuber cinereum, but less by increased intra-cranial tension in general: though this subject evidently requires a more exact inquiry, and a more thorough study of the effects produced by local intra-cranial affections on other regions of the brain. I cannot here refrain from mentioning some important facts collected by Lebert.* "The optic and the auditory nerves are frequently altered at the same time, but if only one of them suffers, it is by preference the auditory." (P. 486.) "Usually the power of hearing was gradually lost on one or both sides, and soon complete deafness supervened; only three times was this sense alone affected, eight times simultaneously with the sense of sight, and three times with disturbances of several

* On Cancer and the Tumors of the Brain and Meninges mistaken for Cancer. Virchow's Archiv, Vol. III.

nerves of special sense. If, therefore, deafness is gradually produced in cases of continuous headache, we must consider the possible existence of a tumor of the brain. But then the diagnosis would still be very doubtful, but if at the same time the sense of sight or still other senses should suffer, we must think of a tumor in the vicinity of the petrous bones, extending further forward." (P. 510.)

Is there any other explanation for a series of disturbances of the senses, following one another with such precision as to justify us in diagnosticating with a good deal of probability a tumor in the region of the petrous bones? A general increase of intra-cranial tension does not explain it, but there must be definite local causes for the degeneration of the chiasma, apart from those cases in which the tumor reaches the chiasma.

2. The changes in the Retina. They were independent of the atrophy of the chiasma. The intraorbital portion of the optic nerves was found almost unchanged. In it was seen neither an atrophy with fat granules or amyloid bodies, nor a proliferation of the interstitial connective tissue. An extension of the degeneration of the chiasma to the peripheric end of the nerve was, therefore, not present, nor could a neuritis descendens be observed.

And yet the changes in the retina, as previously seen by the ophthalmoscope, were very great. We found that the thickness of the retina in the close vicinity of the papilla was increased to about twice its normal diameter, and noticed particularly a proliferation of the granular layer, a thickened connective tissue layer sur-

rounding the vessels, destruction of the layer of nervous fibres, separation of the layer of nervous fibres from the membrana limitans, and an excessive development of the radial fibres.

All these alterations indicate a chronic affection, which may have been of an inflammatory nature (Retinitis). But the inflammation has, at all events, not been transmitted to the retina from a central focus, although there can be no doubt that the tumor of the brain was the cause of it.

But in what way was it developed? From the observation of analogous cases, we must, above all, take into consideration the intra-cranial pressure, which in this case was evidently greatly increased, as proved by the distention of the meninges, the flattening of the convolutions on the convexity of the great hemispheres, and by the dilatation of the ventricles. According to the theory first advanced by Von Graefe, and heretofore generally accepted, we have to deal in such cases with compression of the vena ophthalmica, or the cavernous sinus, as consequence of which we see a choked papilla and different changes in the retina. This explanation was refuted, not long ago, by Sesemann,* who demonstrated that a compression of the sinus cavernosus or the vena ophthalmica could not produce stagnation so long as the flow of blood from this into the vena facialis was not impeded, and that, on the other hand, a compression of the sinus cavernosus was by no means an easy experiment, in which he, at least,

* Reichert's und Du Bois's Archiv, 1869, p. 154.

had never succeeded. It is evident that the development of the choked papilla, and the advanced alterations in the retina, seen in our case, were dependent on other causes than an impeded evacuation of the ophthalmic vein.

When I first saw the considerable dilatation of the space between the outer and inner sheaths of the optic nerve, and at the same time found a marked thickening of the outer sheath, I no longer doubted that the augmented intra-cranial tension had extended from the arachnoidal space to this point, which assumption is corroborated by Schwalbe's* well-known experiments on the connection between the "subvaginal" lymphatic space and the arachnoidal cavity. But having, moreover, found a bag-like dilatation of the anterior end of the subvaginal space around the whole optic nerve, and an especially abundant development of the intravaginal connective-tissue network at this point, I believe that these conditions are the true cause of the alterations in the retina. The excessive filling and dilatation of the subvaginal space at its blind end, must result in strangulation of the retinal vessels in the region of the lamina cribrosa. The correctness of this proposition being conceded, it cannot be difficult to understand the alterations of the retina found at the autopsy, as well as the ophthalmoscopic appearances observed during life, though we cannot yet enter into a discussion of their details.

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* Archiv für mikrosk. Anatomie, Vol. VI. p. 1.

Microscopical Examination of the Tumor, and the Changes produced in the Auditory and Facial Nerves and the Labyrinth.

It will be remembered that the tumor found within the skull was connected with the common trunk of the facial and the auditory nerves, which appeared as a white cord, 2 cm. long and 1 mm. thick, showing under the microscope medullary nervous fibres in all its bundles, but the medullary sheath was nowhere complete, clinging to the numerous free axis cylinders in the form of small scales, here in large patches, there in isolated places and in inconsiderable quantity. Although we do not forget that the specimen was examined only after it had been hardened, this great denudation of entire bundles of axis cylinders remains very extraordinary. All the fibres were colored intensely violet by the chloride of gold. Fatty degeneration of the fibres could not be seen in the specimen preserved in alcohol.

In the report of the autopsy it was stated that a portion of the tumor extended into the porus acusticus internus. We shall now examine this portion on account of the changes found in the labyrinth.

For the study of these alterations, I decalcified the whole labyrinth by a ten per cent. solution of hydrochloric acid, and divided it into fine sections, running in part through the axis of the cochlea and the inner meatus, in part parallel with the contents of the vestibule, when they formed the object of investigation.

Such sections, of which one is represented in Fig. 6, show well, on the one hand, how far the tumor reached,

and, on the other, the lesions of the labyrinth produced by it. With reference to the first, it was found that the inner auditory canal was dilated in every direction, and that its walls were irregular and undulating. The canal was completely filled by the tumor, which was in direct contact with the bone. The bone showed no trace of inflammation, its excavation being the result of simple atrophy from pressure.

A somewhat different condition was found at the bottom of the internal auditory canal, where the tumor was in contact with the base of the cochlea. Here the tumor bulged considerably toward the modiolus, and had caused the tractus spiralis foram. to disappear; yet here, also, it had a sharply defined boundary, and was composed of concentric layers, touching the bone. (Fig. 6, *b*.)

But in the modiolus, *i. e.*, beyond the tumor, the bone tissue behaved differently, appearing composed of uncommonly thin trabeculæ between which were seen numerous blood-vessels and connective tissue. The latter was moderately rich in nuclei, and its intercellular substance was partly of a slightly fibrous, and partly of a more homogeneous nature. This newly formed connective tissue filled all the canaliculi through which, in the normal state, the nerves pass, up to the apices, becoming richer in nuclei and more distinctly fibrillous. The form of the modiolus, or of the lamina spiralis, was not altered at any point. The dilatation, tortuosity and excessive fulness of the blood-vessels was very marked in the periosteum as well as within the bone; and although the vessels of the cochlea are usually very tortuous, they

were here so much more so, that numerous coils could be seen with the naked eye on the outside of the modiolus. In their vicinity much brownish pigment was found, which was mostly deposited in multipolar cells.

Anatomical examination, as well as the negative result obtained by the chloride of gold treatment, showed that of the nervous elements not a trace remained in the whole modiolus. This entire absence of the nervous elements could best be demonstrated in the canalis spiralis modioli, which appeared almost entirely empty. In every section of the canal were seen the lacunæ which had been occupied by the spiral ganglion, but in which, now, hardly any elementary parts were contained; only a few fine trabeculæ, similar to those found in mucous tissue, traversed the lacunæ and here and there embraced a blood-vessel. The appearance of the whole was, however, rather that of a lacuna than that of a space filled with peculiar elements.

To this I hardly need add, that no nerve fibres were seen between the lamellæ of the lamina spiralis ossea; they were replaced by a delicate transparent connective tissue, moderately rich in nuclei, which, without definite boundary, extended into the upper and lower plates. These being deprived of lime, looked more like connective than bony tissue.

A report on the condition of the ductus cochlearis, the walls of which were intact, forms a necessary supplement to the foregoing description.

That no nerves were transmitted through the habenula perforata, was of course to be expected. It was therefore of great importance to determine which parts

of the acoustic terminal apparatus were preserved in our case, and which were not. In this we succeeded beyond our expectations, inasmuch as the elementary parts were much better preserved than we could have hoped for, considering that the specimen was not removed from the corpse till twenty-four hours after death. I look upon this as a proof that, in the future, the pathological histology of the labyrinth will yield more available results than is at present thought probable.

In the first place, I must state that the rods forming the arch around which the other elementary parts of the acoustic apparatus are grouped, were exceedingly well preserved in all the windings of the cochlea (Fig. 7, *f* and *g*). The broader epithelial arch, adjoining the above, was also unaltered on its outer side (towards the wall of the cochlea), and in an outward direction its continuous connection with the epithelium of the zona pectinata was distinctly visible (Fig. 7, *l*). The membrana reticularis, also, was well preserved, as shown in transverse sections and the position of the parts connected with it. I did not make any surface preparations. Corti's membrane appeared in the different sections, as usual, more or less retracted and distinctly striated. The inner portion of the epithelial arch was destroyed; but little weight is, however, to be attached to this, as it is not unfrequently torn off during the preparation. It is especially noteworthy, however, that the inner auditory cells which adhere to the first row of rods had changed their original form. In their place were found small round cells, with a perfectly clear, transparent body,

and a nucleus intensely stained by aniline. Some of these cells were free and densely crowded together; others were attached to the upper ends of the inner rods, and manifested themselves as the original inner upper auditory cells (*h*).

The same change was observed in the outer auditory cells. Immediately below the membrana reticularis lay small round cells, like those above described; the same forms were seen, less regularly, above the membrana basilaris, outwards from the second row of rods, confined between the rods and the sloping epithelial cells. In a section taken from the second turn, I found on the upper surface of two descending auditory cells (cells of Corti), short and long stiff hairs, *i. e.*, processes, which originally extended to Corti's membrane, and which, according to other writers, are cilia-like appendages to the upper terminal surface of these cells.*

From the above it is seen that, with the exception of the terminal nerve cells, which appeared to be atrophied, all the parts of the acoustic terminal apparatus were found in a good state of preservation.

The great development of the vessels was no less marked in the stria vascularis of the cochlear canal than in the modiolus.

Concerning the vestibule and the semicircular canals I have not much to report. The epithelium and connective tissue envelope of the sacculi and membranous canals were well preserved; large and numerous vessels were observed in the envelope. The macula and

* With regard to the terms used here, I must refer the reader to my essay on the development and structure of the labyrinth of the ear. Dresden, 1869.

the cristæ acusticæ were unaltered in form, but no nervous fibres were seen to enter into these structures.

The facial nerve was present from its angle, and entirely filled its osseous canal. In sections of the ganglion geniculi its cells could be recognized with higher magnifying powers; but they were so exceedingly small, clear, and transparent, that they required a good deal of search to be seen. In preparations hardened in Müller's fluid and subsequently stained with aniline, the cell substance around the likewise very small round nucleus was so pale that the greatest attention was necessary to distinguish it between the nervous bundles in sections of some thickness. In short, there can be no doubt that the said ganglion was very much atrophied, and I think that we can assume, with equal certainty, that a part of the cells had been entirely destroyed, since the group still present occupied only a very small space. The nerve fibres running in the canalis Fallopii, towards the periphery, belonged mostly, if not all, to the nervus petrosus sup. major.

I now return to the tumor found within the cranial cavity, the external appearance of which has already been described, for the purpose of adding the results obtained from its microscopical examination. In this connection I may mention that, with regard to its coarse anatomical nature, I have directed my investigation especially to the solution of the question: Is this tumor *a neuroma or a fibrous sarcoma of the auditory nerve?* This discrimination seemed to me necessary, since Virchow,* from his own experience, is inclined

* Die krankhaften Geschwuelste. Vol. iii., p. 296 and 297.

to classify similar tumors of the auditory nerve generally amongst the neuromata. The total destruction of the ganglionic cells and nervous fibres of the cochlea and vestibule, and the partial atrophy of the cells of the ganglion geniculi, did not prevent me from making a closer examination, but I endeavored to arrive at a decision in different ways, as I am of the opinion that the judgment formed has a bearing not only on this, but on many other cases recorded as neuromata.

With regard to its general structural relations, even the weaker magnifying powers showed that the tumor was everywhere composed of a network of fibre bundles, crossing each other in very different directions, whilst their finer elementary parts ran parallel to each other. At the entrance of the inner auditory meatus, almost the entire mass of fibre bundles was arranged parallel to the course of this canal, thereby raising the suspicion of a new formation of nervous fibres. The number of nuclei varied in the several bundles, as was best seen in the sections stained with aniline; at one place they appeared scant, and at another abundant; but, on the whole, they were distributed regularly in each bundle of fibres.

Generally speaking, it may be said that the peripheric portions of the tumor contained more vessels and nuclei than its central portions. A close examination of that part of the tumor lying within the petrous bone, and of which microscopic sections through its entire width are readily made, showed that the structure, at every point where it was in direct contact with the atrophied walls of the internal auditory canal, was

composed of concentrically arranged layers, with comparatively numerous vessels and nuclei. In the centre of the auditory canal the structure was more coarsely fibrous, and when examined by reflected light, its intertwined fascicles presented a distinctly lustrous appearance similar to that of a tendon (preparations in Canada balsam).

The main portion of the tumor lying within the cranial cavity presented somewhat different features. It had throughout the consistency of the softer fibromyomata of the uterus, and was of uniform structure in all its parts; only here and there were seen a few gaping larger blood-vessels. The microscopic sections, whether they were taken from the periphery or the centre, presented everywhere the same picture of interlacing fibre-fascicles of an uncommonly uniform grain, the filaments of which could be isolated, and were frequently in connection with nuclei, placed at regular intervals. That most of the signs considered characteristic of neuromata were present here, I could not fail to observe. A more careful examination has, however, convinced me of their insignificance.

First of all, I must state that the staining produced by the action of the chloride of gold did not show any difference in the several parts of the tumor. None of the fascicles were of a darker color than the rest, and in none of the bundles were the finest filaments made particularly distinct by the solution of gold. The preparation was, on the contrary, of a uniform color throughout, with the exception of the nuclei, which were conspicuous in the basis substance. Amongst the

fibre fascicles were some that could, without a doubt, be declared as coarse connective tissue fibres, as will be demonstrated hereafter. Had the tumor contained nervous elements there would have been a difference in the appearance of the fibres when treated with gold, but none could be seen.

The result is also a negative one from an anatomical point of view. For the purpose of making a comparison, I procured embryonic nerve-fibres of sheep embryos of various ages, and treated the preparations in precisely the same manner as those taken from the tumor, devoting particular attention to the examination of the auditory nerve. This examination has enabled me to point out the following differences :—

The fibrillæ of embryonic nerves had the same thickness and appearance, even if they were arranged in bundles and examined in extensive longitudinal sections.

Most of the nuclei adhering to them were oval, some perfectly circular. On isolation, the bundles split readily into the finest fibres, on which the nuclei formed knotty swellings.

But I lay much stress on the examination of the transverse sections, which in very young embryos showed the axis cylinders when embedded in a substance of a different refracting power, as circular figures or dots, which, according to the illumination, appeared now shining, now dark in the clear field. In the tumor I found nothing of this description, but a more careful examination seemed to disprove directly their nervous character.

To begin with, the tumor contained fibre fascicles, remarkable for their peculiar rigidity. This peculiarity was less apparent under weak magnifying powers, but if very thin sections were placed under superior lenses, it was seen that they were composed of parallel fibres of comparatively great thickness (Fig. 8 *a*). Amongst these were always some which appeared especially broad, but which were not of the same thickness throughout, and on account of their rigidity could be compared only to elastic fibres. Between them lay but few very small oblong nuclei.

Other bundles had a finer striation, which was more or less distinctly visible (Fig. 8 *b* and Fig. 8 *c*), and contained a large number of nuclei, also of an oblong form. These bundles, which formed the bulk of the tumor, might more readily have been taken for nerve fibres, and have, I think, been described as such. On unravelling them, I obtained a result entirely different from that produced by the tearing up of an embryonic nerve-trunk. I obtained undulating fibres of unequal width, which were isolated with difficulty, and between which were embedded small spindle-shaped cells or only oblong or roundish nuclei (Fig. 8 *d*). Thus their faint resemblance to nerves has vanished. On tearing the trunk of a nerve we never obtain rigid fibres so unequal in breadth and direction.

A wholly different appearance was presented by transverse sections of such fascicles. If they were made exactly at right angles to the course of the fibres, the nuclei appeared more densely crowded, of a roundish shape, and were embedded in a finely granular homo-

geneous matrix. (Fig. 8 *e.*) The definite outlines of the axis cylinders were entirely wanting, the presence of which could alone justify us in calling a pathological formation a neuroma.

Lastly, there were parts in our tumor, the fibre fascicles of which, if examined with weak powers, were remarkable only for their great abundance of nuclei. But on examining thin sections of these fascicles with a Hartnack's immersion system No. 10, they were found to be composed of very small spindle-shaped cells, which were so closely aggregated that only a small quantity of slightly fibrous intercellular substance found room between them.

I therefore arrive at the conclusion that the tumor under consideration should be classed among the fibro-sarcomata.

EXPLANATION OF PLATES.

TABLE I.

Fig. 1. Sketch of the tumor (A). The tumor being slightly pushed aside on the under surface of the left hemisphere of the cerebellum (B).

C = Crura cerebelli.

D = The common trunk of the auditory and facial nerves. Natural size.

Fig. 2. A = Transverse section of the left optic nerve, taken from the immediate vicinity of the chiasm. *a* = Sheath. *b* = gray atrophic spot. *c* = Relatively preserved nerve bundles, within which numerous granular bodies are seen.

B = A coarse cord of connective tissue of the sheath, connected with the fine network (*a*) of the atrophic spot, and the nuclei contained in it (*c*).

C = Another place in the atrophic optic nerve : *a* = network ; *b* = nuclei ; *c* = a corpusculum amylaceum. B and C = $\frac{850}{1}$.

Fig. 3. Meridional section through the retina. The broad end of the figure corresponds to a point 1 mm. distant from the papilla; the other end 3 mm. farther outwards.
a = Membrana limitans and the broadened ends of the radial fibres; b and b' = layer of nervous fibres; c = ganglionic layer; d and d' = inner molecular layer; e, g, and k = granular layers; f = outer fibrous layer and outer molecular layer; i = bacillar layer; v = blood-vessel.

PLATE No. II.

Fig. 4. a = The broad ends of the radial fibres; b = lymphatic space; c = layer of nerve fibres, transversely divided; d = inner molecular layer. Immersion system No. 10, Oc. 3.

Fig. 5. Section through the retina, transversely to the course of the larger blood-vessels. The latter surrounded by proliferating connective tissue. The letters have the same signification as in Fig. 3.

Fig. 6. Section through the inner auditory canal and the axis of the cochlea. a = the tumor entering the porus acusticus internus; at b it bulges towards the modiolus. c = dilated vessels of modiolus.

Fig. 7. Section of the acoustic terminal apparatus, from the third winding of the cochlea.
a = lower; b = upper plate of lamina spiralis ossea; c = connective tissue and blood-vessels between the plates; d = membrana basilaris; e = the epithelium of labium vestibulare; f = inner, g = outer rod; h = altered upper inner auditory cell; i = small round cells; k = membrana reticularis; l = the epithelial arch behind the outer auditory cells, which in man is very thick; m = epithelium of zona pectinata.

Fig. 8. Fibre fascicles from the tumor of the auditory nerve. Hartnack's immersion system No. 10. a, b, and c = thin sections; d = unravelled fascicle; e = transversely divided fibre fascicle.

DISEASES OF THE MASTOID PROCESS; THEIR DIAGNOSIS, PATHOLOGY, AND TREATMENT.

By ALBERT H. BUCK, M.D.,

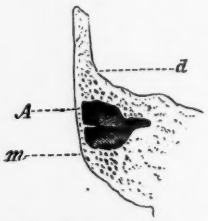
OF NEW YORK.

THE bony prominence, lying behind the ear and known as the mastoid process of the temporal bone, may be the seat of various morbid processes. It is true that these are usually secondary to affections of the meatus or tympanic cavity, where the disease originates and from which it is propagated either to the fibrous covering of the bone or to the peculiar cells which fill its interior. This propagation is not the rule however. In the far larger proportion of cases the inflammation is confined to the locality where it first made its appearance, and only in rarer cases the mastoid body is invaded. These are the cases in which we meet those groups of clinical phenomena which are usually known as mastoid diseases. As a rule we are not justified in giving a new name to morbid processes which are simply extensions of the same vital changes to different portions of the same tissue. In this instance, however, the ultimate pathological results give rise to special trains of symptoms which call for peculiar treatment, and therefore warrant us in regarding the diseases themselves as essentially separate.

Two important facts will attract our attention in re-

viewing the literature of this subject. It will be seen that in a large majority of instances *the disease was not appreciated* and that the *mortality has been very large.* Let us inquire into the causes of these two facts. The rarity of the affection cannot be urged by practitioners as a reason for their ignorance. I have good grounds for believing that such cases occur with tolerable frequency in ordinary practice: they certainly form a fair percentage of the cases which come under treatment at our infirmaries. Much of the fault must be laid to our ordinary text-books on surgery, even the most recent, for they either omit the subject entirely or dismiss it by a brief allusion to caries of the mastoid body as a disease of rare occurrence. We find some attention given to the subject in our text-books on otology and in monographs, but much still remains buried in obscurity.

FIG. 1.



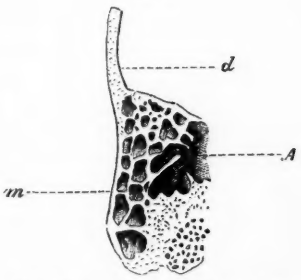
A vertical transverse section through mastoid portion of an infantile temporal bone.
d = dura mater.
A = antrum.
m = rudimentary mastoid process. (Natural size.)

The following article will aim to show the course of the diseases through their various stages. A sufficient number of cases will illustrate the points brought forward, and certain features will be noticed that will enable the ordinary practitioner to recognize the gravity of the affection at an early stage.

At birth the mastoid process consists of a small, flattened tuberosity, containing but one cell of considerable size—the antrum. (See Fig. 1.) At puberty there is a distinct prominence, conical in shape, whose apex

points downwards, and whose length, in some instances, may measure an inch and a quarter. (Figs. 3 and 5.) The substance of this bony prominence is formed of a number of small cavities, or cells, varying very greatly in size and shape. These cells communicate with one another, and are lined with an extension of the mucous membrane of the tympanum. Their mode of distribution and size vary so much in different individuals, that it is scarcely possible to give a description which will be true in even a majority of instances. The accompanying figures illustrate some of the most striking forms. In thickness the outer lamella of bone varies very materially in different individuals; at times being almost as thin as ordinary writing paper. At the posterior end of the tympanic cavity is the entrance to the mastoid vestibule, if I may so call it. This entrance, which is sometimes double, is rather narrow, and lies at a much higher level than the floor of the tympanum.

FIG. 2.



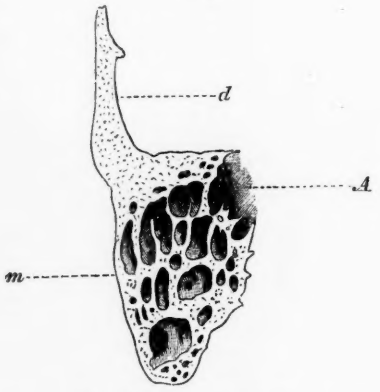
Mastoid process of a child (æt. circa 5). Same section and lettering as in Fig. 1. (Natural size.)

In the adult the vestibule, or antrum (horizontal portion of the mastoid cells, Toynbee) is placed much nearer the dura mater and the lateral sinus than the outer surface of the bone.

It is an irregularly-shaped cavity, oblong in its antero-posterior diameter, and having honey-combed walls

with numerous ridges and intervening depressions, which lead to the surrounding cells. In adults the vestibule is just large enough to admit a small-sized pea, or sometimes a still larger body.

FIG. 3.



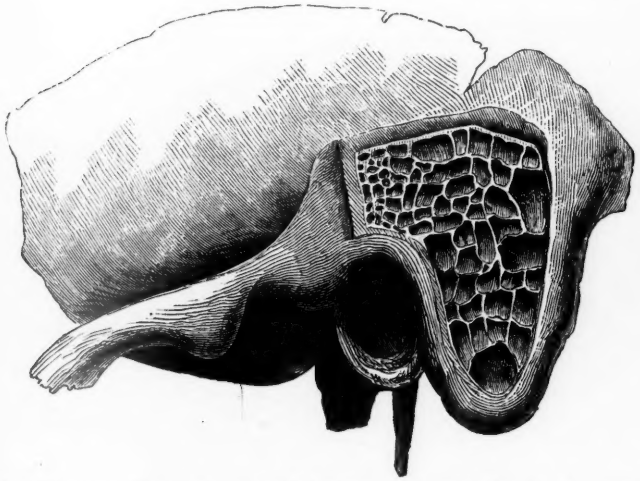
Mastoid process at puberty.
Same section and lettering as in Fig. 1. (Natural size.)

As a rule the cells are not confined merely to the mastoid process, but extend forwards over the external auditory canal, and upwards towards the parietal bone, to a still higher level than the canal. (Fig. 4.) In fact we may regard the entire mastoid system as a collection of bony cells, each one of which is lined with mucous membrane, and communicates with its neighbor by a narrow passage. They all have their final outlet into the middle ear through the antrum.

In no other part of the body do we find a mucous cavity so ill adapted to withstand the action of morbid processes.

In this respect the ethmoid, sphenoid, maxillary and frontal cells, which are the only similar structures, are much more favored. The reasons of this are apparent. The nasal cavity, into which they all open, has very

FIG. 4.



Mastoid process. External portion chiseled away to show how far the cells extend.

broad outlets and is rarely the seat of grave inflammation. The ethmoid and frontal cells have a further advantage: their outlets are at the most dependent portions of the cavities, so that gravity facilitates very materially the discharge of any accumulation. This is not true, however, of the antrum maxillare and sphenoid cavity, though in their case the danger of the extension of an inflammation to the brain is materially lessened by the circumstance that the point of least resistance is on the side toward the nostril, and not toward the brain. In the mastoid cells the reverse is true: their natural

outlets are so small that under inflammatory action they may very readily become closed, and before the imprisoned pus can force its way through the outer table of the bone, the periosteum and thick integuments, there will be great danger of its involving one or both of the adjacent structures—the brain and lateral sinus. The danger is still further enhanced by the passage of one or more small veins through the upper portion of the process, which form a medium of communication between the lateral sinus or its branch, the superior petrosal sinus, and the veins on the outside of the cranium (Henle).

FIG. 5.

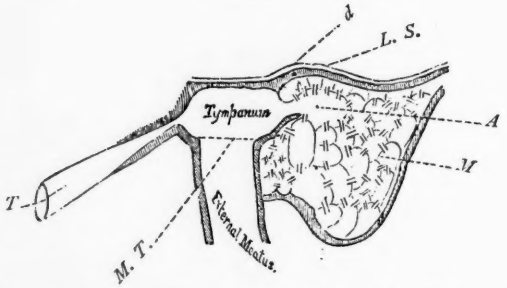


Diagram showing the relations of the dura mater, lateral sinus, external meatus and tympanum to the mastoid cells.

T = Eustachian tube. M = mastoid process.
M. T = membrana tympani. L. S. = location of the lateral sinus.
d = dura mater. A. = antrum.

Disease of the mastoid process may usually be *recognized* under the following forms:—

1. Inflammation of the external periosteum.
2. Simple congestion of the mucous membrane.
3. Congestion and filling up of the cells with a reddish, pulpy material.

4. Chronic subacute inflammation of the mucous membrane with sclerosis or hyperostosis.
5. Caries, with accumulation of pus, within the mastoid process.

The second, third, and fifth forms are simply the three different stages of an acute inflammation; yet for practical purposes it is better to regard them as separate varieties.

I. Inflammation of the External Periosteum.

This occurs as a concomitant symptom or phase of an acute inflammation of the external auditory canal. The periosteum of the mastoid process is a direct continuation of that which lines the meatus externus; hence it not infrequently happens that an inflammation of the latter extends to the mastoid body. As it is characterized by tenderness, pain, and swelling of the parts, it may easily mislead one into the belief that the mastoid cells themselves are the seat of the trouble.

The following case is a good illustration of this first form:—

Case I. (New York Eye and Ear Infirmary).—Sarah Golden, æt. 18, October 16, 1872. No ear trouble until about a week ago, when she began to suffer from a roaring in the left ear, followed shortly by pain, which gradually increased in severity, and extended to the mastoid region. No discharge. Watch heard at a distance of two inches. Outer orifice of the meatus almost closed by the congested and swollen condition of the parts. Beyond the constriction a hard mass of impacted cerumen was seen. The integuments covering the mastoid process were red, swollen, and tender to the touch. Patient evidently in great suffering. The impacted mass was broken down piecemeal, by a probe, and removed with a delicate pair of bent forceps. The

deeper portion of the mass was found to rest against the membrana tympani.

All the unpleasant symptoms rapidly disappeared after the removal of the mass.

In these cases the treatment consists in allaying the inflammation of the meatus, after which the tenderness and pain behind the ear soon disappear of themselves. Sometimes the inflammation of the periosteum results in the formation of an abscess in the subcutaneous cellular tissue of the mastoid region without involving the subjacent bone to any appreciable extent. In such cases the indication is to afford a free outlet to the pus by a suitable incision. The following case illustrates this point:—

Case II. (New York Eye and Ear Infirmary).—March 27, 1872. Benjamin Curtin, æt. 24, a robust, powerfully-built man, was taken with a severe earache and tinnitus nine days ago. No discharge until two days ago. Removal of pus from the meatus brought into view a small mass of granulations, springing from the lower wall, about at the junction of the cartilaginous with the osseous portion. By the aid of a curved probe it was ascertained that these granulations concealed the entrance to a sinus, which led downwards and backwards a distance of three-quarters of an inch. No exposed bone could be felt. The integuments over the mastoid process were red, swollen, and tender to the touch. Membrana tympani red and swollen, but not perforated.

Valsalva's experiment caused pus to escape from the opening in the lower wall of the meatus. Membrana tympani punctured, and pus driven out through the incision by means of Politzer's inflation. Leeches also applied to mastoid region. April 3. Swelling behind the ear is more prominent, and extends much lower downwards. A free incision gave escape to about two ounces of healthy pus. A careful exploration revealed the fact that the bone was still covered at all points by periosteum. From this time the recovery was rapid.

As a point of interest in differential diagnosis it will be well to mention here that a small gland is sometimes found lying directly upon the mastoid process. In certain affections of the middle ear and external auditory canal, this gland becomes painful, swollen, and tender to the touch, and may lead the surgeon to suspect mastoid disease. A few applications of the tincture of iodine usually suffice to dispel the pain and swelling.

II. Simple Congestion of the Mucous Membrane.

The second form may be observed, in a very slight degree, in many cases of acute inflammation of the middle ear. In these cases the patients direct the surgeon's attention to the deeper parts of the ear, and rarely to the mastoid region. In a few cases, however, the trouble is referred chiefly to the mastoid process. These are the cases which may be classified under the head of simple congestion of the mastoid mucous membrane. The following examples will illustrate the prominent clinical features of this form of disease :—

Case III.—Mrs. ....., æt. circa 30, of excellent health, after exposure during house-cleaning on the 1st of May, 1872, began to suffer from sore throat, slight deafness, and pain in the right ear. The pain soon extended to the parts behind the ear, and gradually increased in severity, robbing her of her sleep. On the 6th of May I saw her for the first time, and found the ear in the following condition :—The external auditory canal normal; the membrana tympani red and swollen, though entire; the Eustachian tube closed to Politzer; very marked tenderness on pressure, and some redness of the skin over the mastoid process. Upper portion of pharynx moderately congested. Watch heard when pressed against the ear. Four leeches applied over the mastoid process gave great relief. May 9th. Pain and tenderness

entirely gone. A solution of nitrate of silver (℥j—℥j aquæ) applied to the still swollen membrana tympani. May 13. No return of the pain. Swelling of the membrana tympani diminishing. Watch heard at a distance of half an inch. She subsequently had no return of the pain in that ear, and the improvement in hearing was steady and marked.

On the 8th of the following November I was consulted again for a very similar attack in the left ear. The history given was that about the 1st of November she was attacked with a severe pain behind the ear, accompanied by tenderness on pressure, and a little swelling. The application of six leeches to the affected part relieved these symptoms entirely, but on the previous night the pain returned with considerable severity. On examination I found the left membrana tympani sunken, but not congested. Watch heard at a distance of three feet. There was tenderness over the mastoid process, and some œdematous swelling of the integuments. Six leeches applied behind the left ear afforded entire relief. Since this time there has been no recurrence of the trouble.

Case IV.—(N. Y. Eye and Ear Infirmary.)—Mary A. Hanley, æt. 32, in robust health, was attacked with an influenza on the 9th of November, 1872. She had more or less fever, and a constant catarrh of the eyes and nose. On the 12th, the right ear became involved, the symptoms being moderate deafness, roaring and some pain. Watch heard at a distance of 6 inches. External auditory canal healthy. Membrana tympani dull, opaque and rather flatter than normal. The air during inflation entered the middle ear with a dry sound. Four leeches applied in front of the ear. Nov. 14. The leeches afforded only partial relief. Membrana tympani œdematous in appearance and somewhat convex outwardly. Nov. 15. Passed a bad night. The pain is again severe, and is referred by the patient to the entire side of the head. Tenderness on pressure over the mastoid process. The posterior wall of the external auditory canal has also become tender upon pressure. A free vertical incision through the posterior half of the membrane was followed by an oozing of bloody serum from the wound. By inflation of the middle ear through the Eustachian catheter the serum was made to escape in such quantity that it ran down over her

cheek. Nov. 16. Comparatively free from pain last night. The watery discharge continued through the night, as shown by the stains on the pillow. The tenderness has disappeared, and patient feels quite well again. No subsequent return of the pain.

If the pain should not yield to moderately active local blood-letting (leeching), an incision may be made over the mastoid process, down to and through the periosteum. If both of these means fail to relieve the patient's suffering, and especially if after the temporary relief, which leeches or an incision are pretty sure to afford, the pain returns with even renewed severity and extends backwards toward the occiput and upwards toward the vertex, we may then draw the inference that the disease has already passed into the third, or even the fifth form. As a rule, however, the measures here recommended prove sufficient to check the further progress of the inflammation.

IV. *Chronic subacute inflammation of the mucous membrane with sclerosis, or hyperostosis.*

While this form constitutes a distinct pathological condition, we are not yet in possession of sufficient clinical facts to guide us to a positive diagnosis.

Sclerosis or hyperostosis of the mastoid process, is associated with either chronic catarrhal, or chronic purulent inflammation of the middle ear. Its progress is so insidious and so rarely accompanied by any marked symptoms that it is only at the post-mortem examination, or when called upon to trephine the bone, that we discover the existence of this condition. As the very delicate membrane, which lines the mastoid cells,

serves the double function of mucous membrane, and periosteum to the intercellular bony septa, it will be readily understood how a chronic congestion of the membrane may result on the one hand in thickening of its substance, and on the other in hypertrophy of the bone which it nourishes. In place then of air-containing cavities, separated by thin septa of bone, we find a tolerably dense bony mass, whose substance is studded throughout with small collections of slightly vascular connective tissue. (Fig 6.) Where this condition of things is the result of a chronic purulent inflammation of the middle ear we shall often find that the antrum is the receptacle for a mass of cheesy material, produced by a retrograde metamorphosis of pus, epithelial cells and mucus. Such masses have sometimes been found in the cavity of the tympanum, where the perforation in the membrane was small, or in one of the upper segments. This material probably owes its existence to the fact that the fluid elements of the discharge find an escape through the small outlet, while the solid portions remain behind and gradually accumulate until they form a solid mass, which entirely fills the antrum. From the frequency with which such masses are found in fatal cases of caries of the mastoid process, I think we are justified in believing that their presence in the antrum is not unattended with danger to life. The carious process in these cases appears to originate in the antrum, and its further progress to be confined chiefly to the region lying between that cavity and the fossa sigmoidea. This may be explained by supposing that the pus, prevented by the cheesy mass from escaping through its

natural outlet, sought an escape through the bone in the direction of least resistance, viz., toward the lateral sinus, or the dura mater.

I know of no series of symptoms which will enable us to recognise this form of disease with certainty, though sometimes certain symptoms, like those narrated in case No. 5, should lead us to suspect its existence.

Dr. Hermann Knapp of this city gave me an instance of a case of this kind which came under his observation. Suspecting cheesy matter in the antrum, he introduced a curved probe (as first proposed by Toynbee, Med. Times and Gazette, March 16, 1861) and succeeded in dislodging and removing quite a large accumulation from that cavity. I proposed to make a similar attempt in the following case, in which sclerosis of the mastoid cells with cheesy accumulation in the antrum was suspected. The patient however did not consent.

Case V.—Mr. C., æt. 24, somewhat anaemic, but otherwise in good health, consulted me in March, 1872, for an otorrhœa of fifteen years standing. It had established itself as a sequela of scarlet fever and was accompanied by tinnitus and a dull steady pain, referred to the deeper parts of the ear. Various methods of treatment had been pursued, but the discharge had never materially diminished. An inspection of the ear showed the membrana tympani to have been entirely destroyed, the handle of the hammer resting against the promontory, the mucous membrane pale and very fibrous in appearance, and the posterior upper portion of the tympanic cavity filled with a small mass of granulations which seemed to grow from the entrance to the antrum. There was no tenderness over the mastoid process. The watch could be heard at a distance of 7 inches. A few applications of chromic acid were made, and the granulations shrank entirely out of sight behind the projecting angle of bone.

The subsequent treatment consisted in introducing a probe armed

with cotton, thoroughly cleansing and drying all the parts within reach, and then applying nitrate of silver in solution (the strength being gradually increased from twenty grains to a drachm to the ounce of water). At the expiration of two weeks the discharge was just as abundant as at the first. On the 29th of March, I substituted powdered alum for the silver solution, blowing it in with a suitable tube. The quantity used was just sufficient to form a thin layer over the exposed mucous membrane. On the 30th the patient reported that there had been almost no discharge since the last application. The alum was accordingly applied a second time, after all the remains of the first charge had been removed. This second application was followed in the course of an hour by dizziness, nausea and vomiting, and a throbbing sensation in the ear, without tinnitus. Objects appeared blurred before his eyes. Two hours afterwards he had a second similar attack, which compelled him to take to his bed. The dizziness and nausea continued then for nearly 48 hours, when the discharge reappeared, and he was again able to walk about.

In view of the long continuance of the discharge, of the constant, dull, deep-seated pain, of the presence of granulations which seemed to spring from the entrance to the antrum, and from the throbbing sensation which ensued, when that entrance became closed—as it doubtless did when the alum was applied—it appeared to me probable that the case was one of chronic purulent inflammation of the antrum, associated perhaps with a cheesy accumulation and sclerosis of the mastoid cells; and in this opinion I was confirmed by Dr. Hermann Knapp, who afterward saw the patient with me in consultation. Case No. 16 shows us that we may meet this form of disease in persons as young as Mr. C. ——.*

* Dr. J. L. Vandervoort of this city has given me the following details of a case which perhaps belongs more properly to this than to the first form:—A lady, æt.

III. *Congestion and filling up the of cells with a reddish, pulpy material.*

V. *Caries with accumulation of pus within the mastoid process.*

In very many cases the clinical features of these two forms coincide so closely that it is exceedingly difficult, if not impossible, to distinguish between them. It is only in certain well-marked cases, that we can say: in this case the disease has gone on to the formation of pus in the mastoid cells. The important point, however, is to diagnosticate whether the disease has reached either of these two stages, for if left to itself the third form will soon pass into the fifth and endanger the patient's life.

The following cases will illustrate these two forms of disease.

CASE VI. (reported by Dr. Flaiz, in the Archiv für Ohrenheilkunde, vol. 2). The patient, a man 46 years of age, and previously in good health, was exposed to severe weather during the summer of 1864. Pain in both ears with deafness ensued. His physician sent him to the warm baths at Aargau, but at the end of three weeks he returned having grown worse rather than better. On the 17th of September, 1864, Dr. Flaiz was called to see him. On examination he found the mastoid process of the left side very tender on pressure. The calibre of the external auditory canal was diminished, and filled with pus. The membrana tympani was invisible. Inflation of the middle ear revealed the existence of a perforation in the membrane. Ordered a cathartic and leeches to the left ear.

54, has an exostosis projecting from the central portion of the mastoid process. It is about the size of a nutmeg, hemispherical in shape, smooth and painless, and has existed for over 30 years. When 14 years old she had scarlet fever which left her with an otorrhœa that ceased only twelve months ago. The growth of the tumor was quite slow. It has remained at its present size for many years.

September 20th. No relief yet. Leeches to be repeated. 21st. A free incision over the mastoid process. This relieved the pain, and the wound was allowed to heal.

October 15th. Pain has returned. Fluctuating swelling over mastoid process. Incision and evacuation of half an ounce of pus. No roughness of bone detected. Pain relieved. Wound again allowed to heal. By degrees the pain returned with its former severity, and was referred chiefly to the left occipital and parietal region. October 26th. Patient delirious. Mastoid process perforated with a drill, no pus found. October 27th. Free discharge from the wound. From this time there was a steady amelioration in all the symptoms, and at the end of four weeks the patient was able to resume his work.

In this case we are not informed what the condition of the mastoid cells actually was. It should be remembered, however, that when an operation of this kind is performed, the facilities for making a minute examination into the condition of the bone are not usually at hand; the most we can do is to distinguish the red of the congested mucous membrane, the yellow of the pus, or the whitish hue of the sclerosed bone.

CASE VII. (N. Y. Eye and Ear Infirmary.)—Richard Murphy, æt. 11, phthisical in appearance, contracted about the 4th of September, 1872, a pain in the left ear, in consequence of exposure to cold. Two days later a discharge appeared, and from that time to this (September 11th) he has suffered from severe pain in the affected ear. To-day the discharge ceased. Patient appears to be in great suffering. Pulse 108 and feeble. Tenderness and œdema over the left mastoid process. The external meatus closed by the swelling of its walls. Valsalva's experiment caused dizziness, and retching. The patient being under the influence of ether, an incision was made through the integuments of the mastoid process. The surface of the bone was found to be normal in appearance and consistency. The outer shell of bone was then perforated with a conical drill, which exposed to view the mastoid

cells at a depth of less than two lines. These were found to be highly congested, and the thin bony septa readily broke down under the pressure of the steel director. No pus was found. A small tent was introduced into the wound, and a poultice applied to the parts. Milk and beef-tea diet. Decubitus. September 12th. Pain is gone, but he is unable to keep anything on his stomach. The discharge from the meatus has returned. Some erysipelatous swelling about the wound. Ordered lime water p. r. n.

Sept. 13.—Food retained. General condition decidedly better. Free discharge from the meatus. Wound granulating. No return of pain. Ord. simple dressing to wound, tent to be left out and poultices omitted; also to take quin. sulph. gr. i. t. i. d. and solid food. Sept. 14. Erysipelatous blush is fading away. Sept. 16. Continued improvement. Is now able to leave the house. Sept. 18. A free discharge both from the meatus and from the wound. Ord. iron and cinchona to be substituted for the quinine. Sept. 21. Entire freedom from pain since the operation. His general condition, however, is not so good as when he last visited me three days since. Night-sweats have set in.

Since the last note I have not heard from the boy, and am inclined to think, judging from his low condition, that he did not survive many weeks. The operation certainly gave great relief, but the subsequent copious discharge of purulent matter was too great a strain for a system burdened with phthisis, and he probably succumbed under both.

Case VIII.—Dr. A. P. W., of Chester, S. C., æt. 56, of a strong constitution, consulted me, Oct. 12, 1872, for a painful affection of the mastoid process. He gave the following history:—In 1835 he contracted an acute inflammation of the left middle ear from the bursting of a gun barrel. The severe symptoms soon passed off, but the purulent discharge continued for some time after. Since that time, however, the ear has not troubled him in any way, except that there has

been a moderate degree of deafness and some tinnitus. The perforation in the membrane has always persisted. About the middle of last July he noticed a slight serous discharge from the left ear, and felt a little pain in it. The pain became gradually more severe and was associated with headache and fever. The doctor bled himself to the extent of about sixteen ounces; six hours later he took from the arm an additional quantity of about eight ounces. A profuse suppuration from the ear soon took place and the pain then became tolerable. For a month no marked change occurred in the condition of the ear. The discharge continued, but at times it would almost stop. On the 23d of August he had a rigor, which was followed by a return of all the acute symptoms. The pain was referred to the base of the brain, the mastoid process and the articulation of the jaw. That night the pain, according to his own words, was frightful. Bleeding to the amount of twelve or fifteen ounces afforded some relief, and the discharge again became abundant. For a week the pain remained bearable. On the 31st of August he had another rigor, followed by intense pain, referred to the mastoid process, and thence backward toward the occiput and occipito-vertebral articulation; in fact the whole side of the head was painful. There was tenderness over the mastoid process and the auricle was pushed somewhat out from the head. On the 2d of September, Dr. Darby, Professor of Surgery in the University of Columbia, S. C., and Dr. Robinson, of Winsboro', were telegraphed for, but by the time they arrived the discharge was re-established, and the pain had moderated. The mastoid region, however, was still swollen and quite tender on pressure. On the 18th of September, no improvement having taken place in his condition, the doctor started for New York in the hope of obtaining relief there. The sea voyage from Charleston benefited him very decidedly. The severe symptoms abated, and for some time after reaching this city he enjoyed, at least during the day, comparative comfort; toward night, however, the old trouble returned with greater or less severity. During the few days preceding his visit to me he suffered acutely from pain in the ear.

On examination the meatus was found to be normal, the membrana tympani perforated anteriorly, the Eustachian tube freely open, and only a trace of pus in the middle ear. Mastoid region œdematous and tender on pressure. The tenderness also extends back toward

the occiput. General condition fair. Pulse a little over 90. No heat of skin. At a consultation with Professor James R. Wood and Dr. Hermann Knapp, it was deemed best to perforate the mastoid process. At the patient's own request the operation was performed without ether. The appearance of the bone, after the periosteum had been lifted aside, was entirely normal. The drill was applied on a level with the upper wall of the meatus, and made to penetrate to a depth of three-fifths of an inch without encountering mastoid cells. At this depth, however, a tolerably firm pad of connective tissue was felt. The supposition at the time was, that this mass filled the antrum, but on subsequent inspection I became persuaded that, owing to the thickness of the swollen integuments, and the recumbent position of the patient, I had erred somewhat in the direction which I gave to the drill, pointing it too far backwards. The pad of connective tissue was undoubtedly the outer wall of the lateral sinus.

October 13th.—Passed a pretty comfortable night. Pain much easier than before the operation. Ord. quinine gr. ij. t. i. d.

October 14th.—Pain again severe. Consultation with Drs. Robert F. Weir (Professor Wood out of town) and Hermann Knapp. A second perforation was made, this time nearer to the meatus and on a lower level than the first. Mastoid cells congested, but no pus present. Tent inserted; poultices. Oct. 15. Slight improvement. Appetite rather poor. Ord. tinct. ferri chlor. gtt. X with each dose of quinine. Oct. 16. Appetite better. Temperature 97°. Pain diminishing. Ord. carbolic acid dressings to wound, from which there is a free discharge.

October 17th.—Marked improvement in every respect. Poultices to be stopped.

October 23d.—Tenderness over mastoid process almost gone.

November 14th.—Feels quite well again. There is no discharge from the meatus, and the wound behind the ear has healed except at two points, corresponding to the two sinuses which lead to the perforations in the bone. To return to South Carolina.

A few weeks later I heard from the doctor that there had been no return of the pain, and that his general health was quite good again.

Case IX. (New York Eye and Ear Infirmary.)—Wm. B. Hillison, aet. 45, janitor, previously in good health. In August, 1872, he over-

heated himself, and then sat in a draught of cool air. A few hours later, he experienced severe shooting pains in the right ear, and a throbbing sensation in the mastoid region. The pain continued, with varying severity, for ten days. At the end of this time a discharge appeared, and was soon followed by relief from pain. Early in November the discharge ceased, and the pain again became severe. This time it was referred chiefly to the region behind the ear, and was accompanied by some tenderness and swelling of the parts. The swelling gradually increased, and on December 14th he reluctantly decided to seek medical advice. His physician, Dr. Chas. E. Laight, found the meatus swollen, and the mastoid region the seat of a pretty large swelling. A free incision liberated about an ounce of healthy pus. No denuded bone detected. Dec. 15. Pain relieved. A profuse sweat to-day. Dec. 16. Mastoid region again moderately painful. Wound healing by adhesion. Occasional pain in the right chest. Dec. 18. To-day I saw the patient for the first time, in consultation with Dr. Laight. The pain again severe. The countenance pale. Pulse 108, and feeble. Holds his head as if suffering from a stiff neck. The skin and subjacent tissues over lower portion of mastoid process, and extending at least two inches below it, are soldered by inflammation into a single, flattened, hard mass, red on the surface. Tenderness on pressure, extending up toward squamous portion of temporal bone. Meatus very much swollen, and filled with fetid pus. A small mass of granulations on posterior superior wall of meatus, just beyond the junction of the cartilaginous with the osseous portion. From this point a sinus leads to bare bone, as ascertained by probe. Deeper parts not recognizable. Perforation of the bone advised, and patient recommended to enter the New York Eye and Ear Infirmary. The operation was performed the same afternoon by Dr. Laight. The perforation was made with a drill, which was applied at a point half an inch behind the meatus, a little below the level of the upper wall, and was directed inwards, decidedly forwards, and a little upwards. The instrument first encountered cell-structure at a depth of three-fifths of an inch. No pus. Ordered decubitus, poultices, generous diet, iron and quinine, and sherry wine, ℥ vj. daily.

Dec. 19. Almost entire relief from pain. Pulse 90, and stronger than yesterday. Meatus still swollen. Takes food well. C. T.

Dec. 20. Free discharge from the wound and from the meatus. Steady improvement. The wound and the meatus both to be syringed frequently with a weak solution of carbolic acid.

Jan. 18. The wound has entirely healed except at one point, where a small sinus leads to the perforation in the bone. The sinus in the meatus has also closed. Since the 8th of January there has been no discharge from the meatus. A small perforation still present in the membrana tympani. General condition greatly improved. No return of pain since the operation. Jan. 29. Patient is to-day discharged cured.

Case X. (N. Y. Eye and Ear Infirmary.)—Mrs. Kate Ryan, æt. 36, with syphilitic destruction of the bones of the nose, but otherwise in good health, consulted me January 15th, 1873, for a painful affection of the right ear. She stated that a week previously she was attacked during the night with a severe pain and roaring in the ear. She had always been hard of hearing in that ear, but could not recollect ever to have had a discharge from it. In the course of twenty-four hours she obtained some relief by the sudden giving way of something in the ear and the appearance of a discharge at the outer orifice. Soon, however, the pain returned and gradually became almost intolerable. It extended over the entire side of the head and was accompanied by soreness in front of and behind the ear. No head symptoms.

On examination I found the external auditory canal closed by an œdematous swelling of its walls. Membrana tympani perforated but invisible. Tenderness on pressure over mastoid region; moderate œdema. Tongue coated. Appetite poor. Pulse 90 and of fair strength. No appreciable heat of skin. Incision of the mastoid integuments.

January 16. No relief from the incision. Pulse 104 and feeble. She is evidently in much suffering. Consultation with Dr. Robert F. Weir. Perforation of the mastoid process advised. As the patient preferred to bear the pain, the operation was performed without anæsthesia. The bone was perforated with the larger of the two drills (Fig. 7) to a depth of half an inch, without encountering pus. The cells were few in number, and separated by strong septa. The outer surface of the bone appeared to be perfectly normal. Treatment:—introduction of a tent into the opening in the bone, poultices every four hours, iron and

quinine, and moderate stimulation. January 17. Decidedly better in every respect. Pain moderate. Pulse 88. Takes nourishment well. The meatus and the wound to be syringed every four hours with a warm, weak solution of carbolic acid.

January 22. Continued improvement. Wound granulating. Occasional shooting pains. C. T.

January 29. Entire freedom from pain in the right ear. Wound rapidly filling up with healthy granulations. Almost no discharge from the meatus. Three days ago, without any apparent cause, the left ear became acutely inflamed. Incision of membrana tympani afforded an outlet to the pus. Relief from the pain. February 8. Steady improvement. Left ear free from pain.

February 13. No discharge from the right ear since the 10th. A thin cicatricial depression indicates the location of the former perforation in the membrana tympani. Outer wound entirely healed except at one small spot which is still covered by a scab.

Case XI. (Reported by Von Troeltsch in Virchow's Archives. Vol. XXI., p. 296.)—A girl, æt. 16, while in good health, was attacked with scarlet fever. On the second day after the appearance of the eruption she began to suffer pain in both ears. The pain increased until the fifth day, when a discharge appeared. Subsequent decrease of pain, but at no time entire freedom from it. Constant discharge. When first seen (March 24, 1858) the patient complained of pain in and behind both ears. There was no fever. Tenderness on pressure over both mastoid processes. On the right side, redness and a diffuse swelling behind the ear. Meatus swollen. Membrana tympani perforated. Watch heard only when pressed against the ear. Ordered injections of warm water into both ears four times daily.

March 30. Swelling behind the right ear increased in size. Pain severe. A free incision over mastoid process gave temporary relief.

April 1. Pain again severe.

April 3. A small opening found in the bone. This was enlarged by using moderate force with a buttoned probe. No appearance of pus until a few hours later.

April 4. Pain entirely gone. General condition much improved. By syringing a communication was found to exist between the external fistulous opening and the cavity of the meatus. About the middle of

June the discharge ceased on the right side. External wound nearly closed.

A year and a half later she died of phthisis pulmonalis. At the post-mortem examination the cells of the right mastoid process were found to be very small and in part filled with a semi-gelatinous material.

Case XII.—April 8, 1871, I was called to see Mrs. Peter Green (colored), æt. 47, and of strong constitution. The story was that on the preceding Christmas she had been attacked with severe pain in the right ear, followed soon after by a purulent discharge. Eight days previously, the discharge having almost ceased, she had again suffered from a severe earache, sleeplessness, occasional vomiting and at times incoherence of speech. At the time of my visit she appeared to be in great suffering. Pulse 104 and rather feeble. No heat of skin. Pus escapes through the Eustachian tube into the pharynx. Marked tenderness over the mastoid process. The external auditory canal closed by the swelling of its walls. A free incision over the mastoid process and warm fomentations. April 9.—Last night, soon after the operation, the discharge re-appeared.

April 18. Comparative freedom from pain since the last note. To-day I discovered a mass of granulations springing from the upper and posterior wall of the meatus, a little beyond the junction of the cartilaginous with the osseous portion. May 25. Occasional attacks of pain. June 5th. Another severe attack of pain last night. Motion of the jaws painful. Mastoid process tender on pressure. Ordered two leeches to the part. June 6. Some relief from the leeches. June 15. Since the last note the pain has been steadily growing worse. Leeches have been applied from time to time, but with only temporary relief. To-day there has been some nausea after meals. June 16. A sinus discovered leading from the mass of granulations mentioned above to the mastoid cells. Consultation with Dr. Robert F. Weir. Perforation of the mastoid process advised. The patient being under the influence of ether, an incision was made exposing to view the surface of the right mastoid process. The lower part of the process appeared to be softer than natural. The bone was perforated with a small drill, and the opening afterwards enlarged by means of a small gouge. No pus found. Mastoid cells congested. Two probes intro-

duced into the mastoid process, the one through the sinus, the other through the newly made opening, were found to meet.

From this time there was a rapid improvement in all the symptoms. Her general health, which had suffered materially by the prolonged sickness, soon regained its usual standard. On the 27th of July I was unable to find any trace of the fistulous opening in the meatus, and the discharge had entirely ceased. No return of the pain at any time.

Nos. 6, 7, 8, 9 and 10 afford good illustrations of the third form of mastoid disease. Nos. 11 and 12, however, represent intermediate forms between the third and fifth. Von Troeltsch's (No. 11) appears to be the only case on record in which an opportunity was offered of making a post-mortem examination of the mastoid cells after recovery had taken place. Case No. 12 confirms strongly the view that the third form, when left to itself, passes directly into the fifth. The limited caries in that portion of the mastoid cells, which lies nearest to the external auditory canal, afforded too small and too remote an outlet for the gorged cells of the remaining portion; hence the relief was unappreciable. In the following case, however, death seems to have occurred directly from an extension of the inflammation to the lateral sinus, before any appreciable amount of pus had formed in the mastoid cells. As a rule the mastoid cells will be found to be filled with pus in the cases that terminate fatally.

Case XIII.—(Reported by Dr. Stokes in the British Medical Journal, Feb. 12, 1870.)—A fisherman, æt. 49, of powerful build and temperate habits, was admitted to the Meath Hospital, Jan. 12th, 1870. His history was that on the first day of the year he caught cold and began to suffer from headache. This finally became so severe that

he was obliged to stop work, and seek for relief at the hospital. By questioning him it was ascertained that whenever he caught cold he was subject to a fetid discharge from the right ear.

At the end of 24 hours the head symptoms became more pronounced. Low delirium. Fetid discharge from the ear. Profuse perspirations on this and the following days. On the 17th a sudden and extreme œdema of both eyelids. 20th. Constant delirium. Involuntary evacuation of urine. 22nd. Slight puffiness over the right mastoid process. Integuments incised, but no pus found. Death occurred on the 25th. Up to the last, but very little febrile disturbance.

At the post-mortem examination purulent basilar meningitis found; also superficial softening of antero-inferior portion of the right side of the cerebellum. Lungs free from purulent deposits. Membrana tympani destroyed. Mucous membrane of middle ear pulpy, vascular and bathed in pus. Mucous membrane of mastoid cells in the same condition. Lateral sinus completely obstructed by softening coagula. Purulent matter lay between the outer wall of the sinus and the bone. Same condition in superior and inferior petrosal sinuses.

"From the absence of any fetor, discoloration or softening of the bone it appeared that the lesion which caused death was essentially not a caries, but a suppurative phlebitis of the sinuses of the skull, propagated through the cells of the mastoid bone, from the inflamed mucous membrane of the middle ear."

The change from the third to the fifth form probably takes place in the following manner:—The inter-cellular passages being closed, and the cells themselves filled with the swollen and congested mucous membrane, stasis follows in the local circulation, the bone becomes deprived of its nourishment, and the soft parts filling the cells break down into pus. The bony septa then either become dissolved, forming granular detritus, or separate as a connected whole from the surrounding healthy bone. The following cases afford good illustrations of the clinical features of this fifth form.

Case XIV.—(N. Y. Eye and Ear Infirmary.)—William McClusky, a resident of Orange, N. J., æt. 21, of a healthy constitution, consulted me, Sept. 4th, 1872, for a painful affection of the mastoid process. He stated that in June he was seized with a severe pain in the ear after bathing. The pain continued for three or four days, and then stopped, leaving him quite deaf in the affected ear. At the expiration of two weeks a discharge appeared, and this had continued since until the 4th or 5th day previous to his visit to me. Shortly before the discharge stopped, he noticed some tenderness behind the affected ear. The pain, which for four days had been growing steadily worse, was referred to the mastoid region, whence it extended upwards and backwards to the parietal and occipital regions. Tinnitus. Appetite poor. Countenance pale. Watch heard at a distance of 4 inches on the affected side. The skin covering the mastoid process red and swollen. External auditory canal diminished in calibre by the falling forward of the posterior cutaneous wall. Membrana tympani invisible. Incision of the integuments covering mastoid process. Free escape of pus and blood. The periosteum was dissected up a short distance on either side and the underlying bone seemed healthy. The following day, Sept. 5th, while pressing pretty firmly against the bone with a steel director, it seemed to me that the point of the instrument met with less than the usual resistance. I then attempted to perforate the outer shell with a small steel drill, and in doing so suddenly exposed a large abscess which nearly filled the entire mastoid cavity. The opening was further enlarged with a conical drill until the little finger could be admitted, and the contents were then entirely evacuated. Tent inserted and patient allowed to return to his home where he said he could get further medical treatment. The incision of the integuments on the previous day had already greatly alleviated his sufferings.

On the 14th of November following he wrote:—"The pain never returned since you performed the operation, and the wound healed inside of ten days. I went to a doctor to have it dressed, but he refused to have anything to do with it, and said that it was a very dangerous operation, and might have killed me; so I went to a friend of mine and had it dressed. In ten days the outside was all healed, and I could hear a great deal better. Now I can hear my watch tick about twenty-four inches from my ear."

CASE XV. (New York Eye and Ear Infirmary).—Mrs. Sarah Curry, æt. 62, of a rather feeble constitution, consulted me July 10, 1872, for a painful affection of the left ear. Her story was that for many years she had been somewhat hard of hearing, especially in the left ear, but had never had any discharge from either ear. Two years previously she had an attack of facial paralysis, affecting the left side. After a certain length of time this passed off entirely. About nine weeks previously she began to suffer from pain in and behind the left ear and extending over the entire left side of the head. There was also tenderness behind the ear. For two days and nights the pain was severe. After that there remained a steady, dull aching, together with a moderate degree of tenderness behind the ear. Two weeks previously the acute pain again returned, and since then she had suffered pretty constantly up to the time of her visit to the Infirmary.

On examination the meatus was found nearly closed by a falling forward of the posterior cutaneous wall. Membrana tympani invisible. No appreciable tenderness in the meatus. No discharge. Tenderness over the mastoid process, and also over the lower part of the parietal bone. Watch heard when pressed against the ear. The patient's countenance was indicative of great suffering. Incision of the integuments and periosteum covering the mastoid process. No pus found.

July 13.—Little or no relief afforded by the incision. To-day the auricle is pushed forwards by a swelling behind the ear. Incision entirely healed. A second incision gave exit to about half an ounce of pus. No roughened bone or sinus discovered.

July 18.—Comparative relief from pain until last night, when the pain again became severe. She refers it to the mastoid process, the top and back of the head. The meatus is less swollen and the membrana tympani can now be seen. It is entire, but of a very tough, opaque, tendinous appearance. Eustachian tube open. The entrance of air is accompanied by râles. No brain symptoms. Consultation with Dr. Robert F. Weir. Mastoid process perforated with a conical drill. The outer surface of the bone found to be in every respect perfectly sound. At a depth of about one-fifth of an inch pus was found filling a cavity about the size of a filbert. Pus removed with pledgets of cotton, and outer orifice of the cavity enlarged sufficiently to admit the end of my little finger.

July 19. Patient much relieved by the operation, but she still complains of soreness over the back and side of the head. Pressure over the left occipital and parietal regions produces pain.

July 20.—Severe pain in the head, behind the mastoid process. Appetite only moderately good. Is losing strength. Stimulus ordered. Wound discharging freely.

July 22.—Still severe pain behind the mastoid process. Consultation with my father, Dr. Gurdon Buck. Skull trephined about three-quarters of an inch behind the mastoid process, at the point of greatest tenderness. The outer surface of the bone appeared to be perfectly healthy; but on withdrawing the trephine, after sawing through the outer table, the circular track was found to be filled with healthy pus, which had welled up from the intervening cancellous diploë. No appreciable softening of the bone. The removal of the inner button of bone exposed to view a tense, deep-red dura mater, but no pus. The subsequent oozing of venous blood from the ruptured branchlets was readily checked by laying a pledget of cotton-batting in the circular opening.

July 23, 11 A.M.—Patient slept a part of the night. This morning she has considerable heat of skin. Pulse 100 and feeble. Less pain in the head. Eight P.M. pulse 106 and feeble. Intellect perfectly clear. The discharge from the mastoid process appears to have nearly ceased. Vomited once this evening.

July 24, Noon.—Patient is evidently sinking. Pulse 110 and very feeble. Respirations 44. No râles over anterior and lateral portions of the chest. Intellect still clear, but she has not sufficient strength to speak in an audible tone when answering my questions. She died on the 26th, apparently from exhaustion.

Post-mortem examination refused by the friends.

The disease, if unchecked by operative procedure, may terminate in various ways:—

(*a*) In death, through basilar meningitis (Nos. 16 and 17); abscess of the brain (No. 18); embolus and pyæmia (No. 21); or exhaustion (No. 20).

(*b*) In recovery, after the extrusion of the carious

bone *en masse* or in fragments through an opening in the outer table of the bone, either behind the ear (No. 23), or in the external auditory canal (No. 22). If the caries has resulted in the formation of an abscess, the pus may find an escape through a similar opening. The carious process may also be followed by the growth of polypoid masses in the mastoid process (No. 24).

Case XVI. (New York Eye and Ear Infirmary.)—Michael Casey, æt. 23, a sufferer from pulmonary phthisis, applied to me March 20th, 1872, for relief from a painful affection of his left ear. He stated that two months previously he first noticed a discharge from the left ear; that at first there was no pain connected with it, but that when the discharge became copious, as it did about two weeks before, he began to suffer from earache. On examination, the left meatus was found to to be completely closed by a collapse of the upper cutaneous wall. After the speculum had been forced in for a certain distance, it encountered a mass of granulations, which obstructed a view of the deeper parts. Three leeches applied near the orifice of the meatus.

March 23. Better. The motion of the lower jaw produces pain in the left ear. Granulations removed with Blake's snare. Probe encountered denuded and roughened bone surface in the meatus.

March 30. Paralysis of the left side of face noticed to-day for the first time.

April 6. Œdema of the skin above and behind the ear. Incision over mastoid process gave escape to a large quantity of pus, a part of it lying between the periosteum and the bone, the surface of which was somewhat roughened. Occasional nausea to-day.

April 8. Is steadily losing strength. Pulse 112, and feeble. Suffers great pain throughout left side of head, but does not refer it to the mastoid region. On my advice the patient entered St. Luke's Hospital, where he could obtain proper food and nursing.

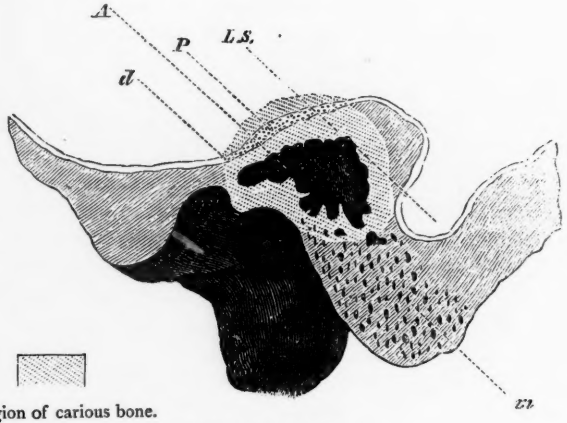
On the 9th of April, Dr. George A. Peters made a free incision through the upper wall of the meatus, exposing to view the denuded and roughened bone, and giving a free outlet to the pus that had accumulated above the auricle, and to that which was constantly forming

in the deeper parts of the ear, but had hitherto found an escape chiefly through the Eustachian tube.

The operation afforded the patient great relief; but in the course of a few days the temperature rose to 106°, the head symptoms became alarming, and the patient died comatose.

At the post-mortem examination, the dura mater covering the convexity of the left hemisphere was found to be intensely red; on the right side it was nearly normal. Pus at the base of the brain on the left side. Dura mater covering the left tegmen tympani thickened,

FIG. 6.



Region of carious bone.
d—dura mater; very much thickened over antrum.
A—antrum.
L.S.—lateral sinus.
P—pus collected between dura mater and bone.
m—mastoid process.
(Antero-posterior vertical section. Natural size.)

(Case No. 16.)

and of a maroon color. The thickened portion, whose limits were very abrupt, could easily have been mistaken for a swollen Peyer's patch, as seen in typhoid fever, so close was the resemblance between the two. Between the swollen dura mater and the greenish, softened

tegmen tympani lay quite a collection of cheesy, disorganized pus. The lateral sinus was not involved. The antrum mastoideum was nearly filled with a cheesy mass enveloped in a coating of foul greenish pus. The mastoid cells were sclerosed. A small sinus led from the outer surface of the upper portion of the process directly inwards to the antrum. (It was not detected during life.) The tympanum was filled with the same greenish, foul pus, which had also accumulated in the vestibule and scala tympani, owing to the destruction of the stirrup and membrane of the round window. The lining mucous membrane of the tympanum was not recognizable; the pus seemed to be lying in direct contact with the bone. Membrana tympani totally destroyed. The cavity of the temporo-maxillary articulation filled with pus. Eustachian tube ulcerated and very much enlarged. The pus had also burrowed down in the direction of the basilar process of the occipital bone.

Case XVII.—On the 21st of September, 1872, I was asked by Dr. Hermann Knapp to see with him, in consultation, a Mr. F., æt. 57, and of a strong constitution. The history of the case was briefly this: During the previous ten or twelve years Mr. F. had had five distinct attacks of acute purulent inflammation of the left middle ear, from all of which he made a good recovery. The present attack began about seven weeks previously, and was characterized by headache and dulness of hearing, unaccompanied by discharge. On examination of the ear Dr. Knapp found the external auditory canal swollen, especially on the posterior side; the membrana tympani injected, and the mastoid process tender on pressure. In the progress of the disease, the membrana tympani becoming more congested and convex outwardly, the doctor incised it. No pus escaped, but the patient experienced relief from his suffering for about a week. The pain then returned, and the integuments covering the mastoid process became swollen. The patient also noticed a gurgling sensation in the ear, whenever he shook his head. An incision down to and through the mastoid periosteum afforded only temporary relief. The pain again became severe. At the consultation (Sept. 21) it was decided that perforation of the mastoid process was the only course that offered any hope of recovery. The patient however refused.

Sept. 22. Up to this time there had been no brain symptoms, but

to-day, being called in haste to see the patient during the absence of Dr. Knapp from the city, I found him unconscious, pupils non-responsive, face flushed, and head very hot; pulse about 120, and full; breathing stertorous. The friends were then willing enough to have the operation performed, but it was clearly too late. The patient died the same night.

At the post-mortem examination, purulent basilar meningitis was found, together with a free communication between the mastoid antrum and the cavity of the lateral sinus. The two formed together an irregularly-shaped cavity filled with pus. The pus did not extend down into the jugular vein, nor back toward the torcular Herophili. Both these portions of the vein contained venous blood. Sclerosis of the mastoid cells. Membrana tympani entire.

CASE XVIII. (Reported by Von Troeltsch in the "Archiv für Ohrenheilkunde," Vol. IV.)—A girl, æt. 20, of habitual good health, but affected for more than ten years with a discharge from the left ear, began to complain in November, 1866, of frequent headaches. Her family also noticed that she was depressed in spirits. On the 6th of January, 1867, the headache returned with great severity. On the 8th of January the family physician was sent for. He found her somewhat feverish, pulse 96, occasional vomiting; she complained of great pain, of a boring, lancinating character, in and around the left ear. Fetid otorrhœa. Ordered six leeches to the ear, cold applications to the head, and calomel internally.

January 9. Pain still severe. Vomiting. Pulse 110. Ordered six leeches to ear.

January 10. Pain less severe.

January 11. Delirious during the night. Pulse 120. Ordered leeches for the fourth time.

January 13. Some stupor. Pulse 140. She died on the 14th.

At the post-mortem examination an abscess was found in the left cerebellum, and one also in the left lower lobe of the cerebrum. Discoloration and thickening of the dura mater over the tegmen tympani. Discoloration of the bone near the mastoid antrum, which was filled partly with a greenish pus, and partly with cheesy material. Mucous membrane of the tympanum green, swollen and ulcerated. The membrana tympani very much thickened and defective in the upper and

posterior portion. (This, however, may have been artifically produced by the saw). The vestibule of the labyrinth filled with a brownish semi-fluid substance.

CASE XIX. (Reported by Ludwig Mayer in the "Archiv für Ohrenheilkunde" Vol. I.)—A boy, æt. 15, of good health, was attacked July 10th, 1864, with a severe pain in the region of the left ear, chiefly behind it. For fifteen months previously he had been troubled with a discharge from that ear. An examination of the parts revealed swelling and tenderness over the left mastoid process.

July 13. Patient had a chill to-day. Steady increase in the severity of the pain. Dizziness, fever and loss of appetite. Pulse 130. Discharge fetid. Motion of jaws painful. Meatus filled with pus, but not tender on pressure. Membrana tympani entire and of a milky hue. Polypoid granulations on the upper wall of the meatus near the membrana tympani (Dr. Mayer states that probably a sinus led from this portion of the meatus into the cells which often lie above it.) Incision over mastoid process. Surface of bone rough. Perforation performed with a trocar. Very little pus found. Ordered poultices.

July 14. Much better. Pulse 72.

July 16. Chill followed by sweating. Pain in head. Ordered fifteen leeches to the left mastoid region. Discharge from the meatus has ceased.

July 17. Double vision. Several passages from the bowels. Chill.

July 18. Delirium.

July 20. Comatose. Patient died on the 22d July.

Post-mortem examination not allowed.

CASE XX—Mr. I. H. N., æt. 40, a sufferer from pulmonary tuberculosis, was sent to me in consultation by Dr. William Hyde, of Stonington, Conn. He stated that he became somewhat deaf in the left ear eight years previously. In the autumn of 1871 he was attacked with pain, roaring and throbbing in the left ear, followed in the course of a week by a discharge. Since then the discharge had never ceased, and there had always been more or less pain. On one occasion he found a small fragment of bone in the discharge. Pain pretty severe recently, but not referred specially to the mastoid process.

The condition of the patient at the time I saw him was that of a person advanced in phthisis. An examination of the ear revealed a

marked degree of deafness, tenderness over the mastoid process, and pus escaping from the meatus, which was quite blocked up by the presence of a mass of granulations, springing from the upper and posterior cutaneous wall. During the exploration I extracted four loose fragments of bone, which were evidently bony septa from the mastoid cells. By aid of a curved probe I ascertained that a sinus led from the meatus (quite near the outer end of the osseous portion) backwards into the very centre of the mastoid process. In its course the probe encounttered two or three sharp projecting spiculæ of bone. The patient was so feeble that I was obliged to desist from further exploration.

On the 28th of September following the patient died, with no other symptoms than those of exhaustion. Two days before death, there was a considerable hæmorrhage from the ear.

No post-mortem examination made.

Case XXI. (Reported by Von Troeltsch, in the "Archiv für Ohrenheilkunde," vol. iv.)—Patient entered the hospital March 30th, 1866. She was 21 years of age, and in the sixth month of pregnancy. She complained of daily chills followed by fever and sweating. During these attacks she suffered from severe frontal headache. The diagnosis of febris intermittens was made, and quinine prescribed in moderate doses. On the 5th day a purulent discharge from the right ear was discovered. The patient said it had existed for three years. On examination œdema and redness of the skin were found in the neighborhood of the ear, and extending back toward the occiput. Meatus swollen and filled with thick pus. Treatment: frequent syringing of the ear with warm solutions of acetate of lead; blister to the mastoid process; poultices. On the seventh day some delirium. Right pupil more dilated than the left. The chills continued in spite of large doses of quinine. On the 13th of April the child was born. It lived but a few hours. On the 15th diarrhœa; patient comatose; increase of swelling around the ear. April 17. Profound coma and death.

At the post-mortem examination the following pathological conditions were found: phlebitis of the right lateral sinus. Metastases in the lungs. Tissues around the right ear infiltrated with pus. Pia mater of the right hemisphere much congested. Dura mater along the right lateral sinus very vascular, and of a greenish hue. Within the sinus

transversus a purulent, yellowish-red material. Along the upper surface of the petrous bone, beneath the dura mater, two distinct collections of a creamy, yellowish-green pus. Beneath one of these collections, the bone was found to be rough and discolored. Pus between periosteum and right mastoid bone, whose outer surface was discolored. Upper and posterior wall of the meatus decidedly swollen. Membrana tympani intact but very much thickened, and of a bluish red color. Bony roof of antrum perforated by caries. Antrum itself entirely filled with cheesy pus. The cells of the mastoid process converted into a large cavity containing discolored pus and fragments of bone. The adjacent bone green. The cells immediately above the meatus filled with thickened, discolored pus; lining membrane everywhere much thickened and congested. Tympanum filled with dried pus.

Case XXII.—(Reported by Dr. Chas. Laight in the Transactions of the American Otological Society, July, 1871.)—William Quinn, æt. 13, of good health, was admitted to the N. Y. Eye and Ear Infirmary July 5th, 1871. He stated that six years previously he had been sick with a painful affection of the left ear followed by a discharge which had continued ever since. Present condition:—Pain in the ear. General condition good. An examination of the ear revealed the presence of a loose mass of bone in the meatus; it was attached only by a small fleshy peduncle to the upper cutaneous wall. Discharge very fetid. Bony mass removed. On examination it proved to be a portion of the mastoid process, about the size and shape of a small bean, which had come away as a single sequestrum. Further examination revealed the existence of a correspondingly large sinus, leading from the external meatus back into the adjacent mastoid cells.

The pain passed off at once, after the removal of this large sequestrum, and the otorrhœa soon after ceased entirely under appropriate treatment.

Case XXIII.—A. B., æt. 15, of robust health, consulted me on the 28th of September, 1871, for a deafness of the left ear. The history of the case, so far as I could ascertain it, was as follows:—When a small child he had measles, followed by inflammation of the left ear. For several years subsequently there was a discharge from the outer orifice

and some difficulty behind the ear, but exactly what was the nature of that trouble he could not recollect. For the past three or four years, however, he had been entirely free from otorrhœa.

On examination I found evidences of a former purulent inflammation of the left middle ear. Behind the ear there was a deep depression in the skin, corresponding to a similar depression in the mastoid process, a large portion of which had come away, either *en masse* or in fragments, through an opening on the outer side of the bone. This depression was large enough to admit the end of my little finger.

Case XXIV.—(N. Y. Eye and Ear Infirmary).—Catherine Bergeman, æt. 42, of healthy appearance, consulted me February 7th, 1872, with reference to a polypus in the right ear. Her history was simply this:—From childhood she had always been troubled with a discharge from the affected ear, and had first noticed the existence of the polypoid growth about six years previously. On inspection I found a rather tough, fleshy mass, presenting at the outer orifice, and extending out a little distance from it. With Blake's snare I succeeded in extracting the mass entire. The subsequent hemorrhage was moderate and soon ceased of itself. An examination of the parts then showed that this large polypus (length $1\frac{3}{4}$ in., greatest diameter $\frac{3}{8}$ in.) sprang from the farther end of a broad sinus, which led from the external osseous meatus far back into the mastoid process. No exposed bone could be felt with the probe. No trace of membrana tympani or ossicles.

Four days later I again saw the patient and ascertained that there had been no discharge since the removal of the polypus. Subsequently she did not make her appearance.

These cases will serve to illustrate the chief characteristics of mastoid diseases, with the course they pursue either towards a favorable or a fatal issue. In concluding this portion of the subject, I shall briefly recapitulate the symptoms that will lead us to diagnosticate between these different varieties, and then take up the question of treatment.

In simple periostitis we have tenderness on pressure,

pain and swelling of different degrees. If we find the external auditory canal inflamed, without any appreciable trouble in the middle ear, we may feel pretty sure that the inflammation is limited to the outer fibrous textures. The pain too is not so deeply seated, nor has it the same intensity as when the cells themselves are affected. Pus occasionally results from this inflammation.

In simple congestion of the mucous membrane we may expect to find tenderness on pressure, pain and swelling of the integuments. If we remember that this is simply an extension of the diseased process from the middle ear, the difficulties in diagnosis will be materially lessened. As a rule, we shall find the pain more intense and deeper seated than in simple periostitis, and the external auditory canal will be unaffected. The relief which follows local depletion or an incision will distinguish it from other mastoid diseases.

Chronic subacute inflammation is not characterized by any definite train of symptoms. Its existence can only be shown by direct physical examination.

In the two remaining forms, it is scarcely possible to make a differential diagnosis, except perhaps in certain well-marked examples. This, however, is unnecessary, for the treatment in both cases is the same. The symptoms of pain and tenderness on pressure are almost invariably present. Dr. Roosa's case (No. 25 of the statistical note) is the only exception I know of. These two symptoms will not be permanently relieved by local depletion, or incision of the integuments or membrane. In some cases there is an entire absence of swelling. There are certain other phenomena observed in these

two forms which vary more or less in constancy. They are so valuable as aids to diagnosis that I shall mention them somewhat in detail.

(*a.*) Prolapse of the posterior or superior wall of the external auditory canal has been noticed in a few cases. In all of them it seemed to be associated with caries of the meatus. Swelling and tenderness of the posterior wall are frequently present in both forms.

(*b.*) Brain symptoms do not always indicate uniform pathological conditions. They may occur in inflammation with or without pus. They may also be absent when there is extensive caries of the part with local meningitis.

(*c.*) Facial paralysis is an occasional intercurrent symptom, and usually indicates that the bony walls of the tympanum, in which the nerve is embedded, have become involved.

(*d.*) Cessation or marked diminution of the purulent discharge is the usual precursor of acute mastoid inflammation.

(*e.*) In rare cases the membrana tympani remains entire.

(*f.*) The discharge of pus through the Eustachian tube indicates that some obstruction exists preventing its escape by way of the meatus.

(*g.*) The presence of granulations, springing from either the upper or posterior wall, should lead us to suspect that there is an opening leading to the mastoid cells. This fact can easily be ascertained by exploration with a bent probe.

Treatment.—The preceding cases illustrate so fully the methods of treatment to be adopted, that we have nothing new to add. We shall, therefore, simply give a brief recapitulation.

In the earlier stages of disease, when there is merely pain, tenderness on pressure, and perhaps swelling in the mastoid region, the most prompt relief can be afforded by local depletion. Apply from four to ten leeches, and follow them with warm fomentations. The external auditory canal and middle ear should then be carefully examined and treated according to indications. No reliable exploration can be made without the speculum and reflector.

If these measures do not give relief, and the unfavorable symptoms persist, a free incision through the integuments and periosteum of the mastoid process should be made.

The knife should enter at the level of the upper wall of the meatus, about ¼ inch posteriorly to the insertion of the auricle, and should extend downwards nearly to the tip of the process.

Should this latter procedure also fail, the bone should be trephined or perforated in such a way as to expose the mastoid cells.

This latter operation has now been repeated so many times that its great value and comparative freedom from danger have been securely established. It may be easily performed and will enable us to save life in a large majority of cases where a fatal termination is imminent.

Out of thirty-one cases (see statistical note), in which

the operation has been performed, the progress of the disease was arrested in twenty-three; in the remaining eight fatal cases, death could not be attributed to the operation, directly or indirectly, in more than one case (No. VII). In the remaining seven cases the operation was performed too late: pyæmia had already developed itself, or there was already inflammation of the brain or its membranes; or pus in the lateral sinus.

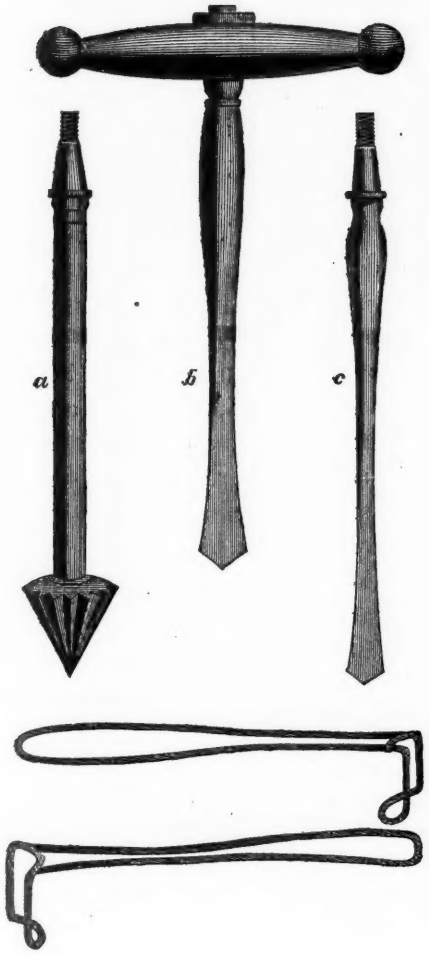
Some surgeons discountenance the operation in young persons, and claim that the disease in such cases will almost always terminate in recovery by a spontaneous perforation of the outer bony wall.

The incorrectness of this view will be shown further on in the statistical note. We are unable to judge of the comparative fatality of such cases from the insufficiency of our data. It will be seen, however, that a sufficient number of fatal cases are on record to make it unsafe for us to trust to natural processes only.

The steps of the operation are briefly as follows:—

A free vertical incision should be first made through the integuments and periosteum of the mastoid bone. The condition of the bone should then be noted. If it be soft or roughened, an attempt should be made to break through the outer lamella by firmly pressing upon it with the end of a steel director. If pus be found between the periosteum and the bone, search should be made with a bent probe for a sinus through which the pus may have found an escape from the mastoid cells. If such a one can be found, apply the drill or trephine at this point, and simply enlarge the existing opening. If no opening be found, dissect up

FIG. 7.



Drills for perforating the mastoid process.
Retractors.

the periosteum from that portion of the mastoid process which is situated immediately behind the external auditory canal, and apply the trephine or drill* at a point a quarter of an inch distant from the canal and a little below the level of its upper wall. The drill should be rotated in a direction inwards, forwards, and a little upwards: that is, nearly parallel with the canal. The depth to which the instrument should be carried will vary in different cases. The aim should be to reach the peculiar cell-structure of the mastoid process. If the patient be an adult, and the case be one where sclerosis of the mastoid cells existed before the development of the acute symptoms, it may be necessary to penetrate to a depth of three-fifths of an inch to reach the mastoid antrum, the usual center of disease in such cases. Ordinarily, however, the fragile cell-structure will be found at a depth of a fifth of an inch. The drill can then be withdrawn and the steel director used to break down the bony septa. In infants the antrum is situated so near the outer surface of the bone that very little effort will be required to establish the desired opening. The only danger connected with this operation is that of wounding the lateral sinus.†

The after-treatment consists in:—*a*, inserting a tent of lint to prevent union by adhesion: this tent should

* The drill appears to me to be preferable to the trephine. Fig. 7 gives the actual size of the three different drills best adapted to this purpose.

† In Dr. Weir's case (No. 27 of table of operations) the outer wall of the sinus was exposed over a circular space a third of an inch in diameter. At the post-mortem examination, twelve days later, this part was examined very carefully, and yet no trace could be detected of any inflammatory action, either in the fibrous wall or in the neighboring bone.

be replaced by fresh ones at least once in twenty-four hours, until suppuration is freely established; *b*, poultices, until the pain moderates and free suppuration becomes established; *c*, carbolic acid dressings and lotions frequently repeated.*

STATISTICAL NOTE.

The following statistics are based upon the record of sixty-seven cases, a small portion of them taken from my own case-book, the majority from the various medi-

* Lallemand (Recherches anatomico-pathologiques sur l'encéphale. Vol. II., p. 87. Paris, 1825), relates the following narrative as an illustration of how these cases may become the subject of medico-legal inquiry:—

J. Conrard, æt. 20, pale, thin, and of a feeble constitution, was struck several times while quarreling with another boy, and in consequence fell sick. He had all the symptoms of an ataxic fever and died on the 20th day.

The magistrate, believing that death might have been produced by the blows the boy had received, ordered the body to be opened and examined. The physicians reported "that they had found:—1, the brain rather more congested than natural; 2, a thin layer of pus between the under surface of the brain and the dura mater; 3, a collection of pus in the anterior portion of the right lobe of the cerebellum; 4, the arachnoid in contact with the right petrous bone, adherent to the dura mater and of a deeper red than normal."

A superficial observer would have felt justified, in the presence of such ample evidence, in attributing the boy's death to the blows he had received twenty days previously. Happily, the physicians, whose duty it was to enlighten the consciences of the jury, were not hasty in arriving at a conclusion. As there was no trace of any serious contusion on the surface of the cranium, and as the abscess was contained in a well organized cyst, they questioned the boy's parents about his antecedent history, and ascertained—thanks to their truthfulness—that their son had been troubled with his head for a long time previously, and had been subject to attacks of pain in the right ear. The physicians then returned to the body and made a further examination of the temporal bone, which resulted in their finding the mastoid cells filled with pus, and the middle ear similarly affected. They then reported "that the disorganization which they had found must have existed already before the occurrence of the fight and had no connection with it: that it was simply possible that the blows may have hastened the course of the disease."

cal periodicals and works on otology which were within my reach. Only those cases were taken in which the post-mortem examination or the clinical history afforded unmistakable evidence that the mastoid cells were diseased (third or fifth form).

Out of sixty-seven cases I found that thirteen occurred in children 10 years of age and under,

26 in persons between the ages of 10 and 25,
9 " " " 25 " 40,
12 " " " 40 " 55, and
7 " " " 55 " 62.

The youngest patient was 8 months old, the oldest 62 years. More than half of the patients were under 25 years of age. Six of the cases belonged properly to the third form, two were doubtful (third or fifth), and the remainder belonged to the fifth. Of the entire number three terminated in a spontaneous recovery, twenty-two were operated upon and recovered, eight were operated upon and died, and the remainder, thirty-six in all, terminated fatally. All the cases of spontaneous recovery occurred in persons under 16 years of age.

TABLE OF OPERATIONS ON THE MASTOID PROCESS.

No.	Where reported and name of operator.	Age.	Form of disease.	Otorrhœa.	External appearances of the bone.	Instrument used.	Result.
1	Jasser, 1776.... (Arneman's Bemerkungen über die Durchbohrung des Processus mastoideus. Göttingen, 1792.)	Adult.	Simple deafness.	None.	Normal.	Trocar.	Recovery from operation.
2	Fielitz..... (Ibid.)	Young Adult:	Not clearly stated.	Present.	Not stated.	Some kind of borer.	Recovery
3	Fielitz..... (Ibid.)	An old woman	Simple deafness.	None.	Normal.	Same.	Recovery from operation.
4	Löffler..... (Ibid.)	Adult.	Simple deafness.	None.	Normal.	Same.	Recovery from operation.
5	Hagstroem..... (Ibid.)	Adult.	Simple deafness.	Not stated.	Normal.	Gouge.	Recovery from operation.
6	J. L. Petit..... (Von Troeltsch's work on Otology.)	Not stated.	Not stated.	None.	Not stated.	Gouge.	Recovery
7	Weber..... (Mentioned by Von Troeltsch in Virchow's Archives, vol. xxi.)	44	5th.	Present.	Not stated.	Not stated.	Recovery
8	Forget..... (L'Union Médicale, 1860, No. 52.)	14	5th.	Present.	Not stated.	Not stated.	Recovery
9	Follin..... (Gazette des Hôpitaux, 1864.)	44	5th.	Present.	Not stated.	Trephine.	Recovery
10	Ludwig Mayer.. (Archiv für Ohrenheilkunde, vol. i.)	15	5th.	Present.	Roughened	Trocar.	Death from pyæmia.
11	Flaiz..... (Arch. für Ohrenh., vol. ii.	46	3d.	Present.	Normal.	Drill.	Recovery
12	Jacoby..... (Archiv. für Ohr., vol. iv.)	48	5th.	Present.	Pus on the outer side of bone, but no roughn'ss or softening.	Drill.	Recovery

TABLE—CONTINUED.

No.	Where reported and name of operator.	Age.	Form of disease.	Otorrhœa.	External appearance of the bone.	Instrument used.	Result.
13	Jacoby ..... (Archiv für Ohr., vol. vi.)	10	5th.	Present.	Not stated.	Drill.	Recovery
14	Jacoby ..... (Ibid.)	37	5th.	Present.	Not stated.	First with drill, later with trephine.	Death.
15	Jacoby..... (Archiv, vol. v.)	20	3d.	Present.	Normal.	Drill.	Recovery
16	Kessel ..... (Archiv. für Ohrenh., vol. iv., p 58.)	24	5th.	Present.	Not stated.	Trocar.	Recovery
17	Pagenstecher ... (Mentioned by Jacoby, in the Archiv. für Ohrenheil., vol. iv., p. 222.)	60	5th.	Present.	Not stated.	Cartilage knife.	Recovery
18	Pagenstecher ... (Ibid.)	Not stated.	Not stated.	Present.	Not stated.	Drill.	Recovery
19	Hinton ..... (Med. Times & Gazette, Sept., 1868.)	58	5th.	Present.	Not stated.	Trocar.	Recovery
20	Colles ..... (Dublin Quarterly, Aug., 1870)	Middle Age.	5th.	Present.	Not stated.	Drill.	Recovery
21	Buszard..... (British Med. Jour., Jan., 1871.)	40	5th.	Present.	Small sinus in upper portion of mastoid process.	Trephine and chisel.	Recovery
22	Barwell..... (Lancet, April, 1871.)	6	5th.	Present.	Softened at one point.	Pointed gouge.	Recovery
23	Barwell..... (Ibid.)	47	5th.	Present.	Not stated.	Same.	Recovery
24	Stokes..... (Dublin Med. Jour., Aug., 1870.)	49	3d.	Present.	Normal.	Semi-circular saw.	Death.
25	Agnew..... (Trans. Amer. Otol. Society, 1870.)	Middle life.	5th.	Present.	Small sinus.	Trephine.	Recovery
26	Roosa ..... (Ibid.)	38	5th.	None.	Small sinus.	Not stated.	Death.
27	Weir, N.Y. City (Reported verbally. I was also present at the operation.)	12	3d.	Present.	Normal.	Drill.	Death.

TABLE—CONTINUED.

No.	Where reported and name of operator.	Age.	Form of disease.	Otorrhœa.	External appearance of the bone.	Instrument used.	Result.
28	Laight, N. Y. City (Reported verbally. I was also present at the operation.)	45	5th.	Present.	Normal.	Drill.	Recovery
29	North ..... Waterbury, Ct. (Reported verbally.)	19	3d.	Present.	Normal.	Trephine.	Death.
30	Buck	62	5th.	None.	Normal.	Drill.	Death.
31	Do.....	11	3d.	Present.	Normal.	Drill.	Death.
32	Do.....	21	5th.	Present.	Softened.	Drill.	Recovery
33	Do.....	56	3d.	Present.	Normal.	Drill.	Recovery
34	Do.....	47	5th.	Present.	Normal.	Drill.	Recovery
35	Do.....	36	3d.	Present.	Normal.	Drill.	Recovery

The cases of Jasser, Von Troeltsch, and Turnbull are omitted from the list simply because I can find no evidence in the printed reports of these cases that any operation was performed upon the bone, beyond the mere introduction of a buttoned probe into a small fistulous opening. Other cases have been omitted through inability on my part to gain access to the printed reports. The names of these surgeons are Pagenstecher, Schwartze, and Von Bruns.

A SYSTEMATIC METHOD FOR TESTING AND RECORDING THE ACUTENESS OF HEARING.

By H. KNAPP.

For some years I have been in the habit of testing and recording the acuteness of hearing in a manner similar to that which has become general for the determination of the acuteness of vision. In the winter of 1871 and 1872 I described this method, both in my lectures on Otology and at a meeting of the New York Ophthalmological Society. By the discussion of the subject in this Society, I learned that Dr. J. S. Prout, of Brooklyn, was in the habit of recording the acuteness of hearing in a similar manner, which, shortly after that meeting, he described in the weekly "Boston Medical and Surgical Journal," Feb. 29, 1872.

Neither the mode of examining nor that of recording I am going to describe, offers anything particularly new, but it has the advantage of combining the ordinary tests in a method, and of recording the results in a way both simpler and more comprehensive than the clumsy phraseology used in otological literature.

The basis of our considerations is the *expression of the degree of deafness by a fraction of the normal standard of hearing power.* There are some difficulties to be overcome which do not exist in the determination of the acuteness of vision: we have no test for the sharp-

ness of hearing that compares, as to uniformity and universal applicability, with the test types of oculists. Moreover, we have to examine the ear for its power to perceive different *qualities*, not solely different *intensities*, of sound. These qualities are: *noises*, *musical tones*, and, what is more important, the *human voice*, a mixture of music and noise.

The minimum intensity of each of these qualities of sound, perceived by the majority of people with healthy ears, determines the normal standard of hearing. The increase of the intensity of sound required by a defective ear, indicates a proportional diminution of the normal hearing. We have to determine the minimum intensity of each quality of sound in each ear, and compare it with the normal minimum. This comparison expresses the acuteness of hearing as a fraction of the normal. If we had an instrument of general applicability with which we could measure the intensity of sound, nothing would be easier than to determine the acuteness of hearing. As long as we have no such instrument, we must do the best we can with the means that are now at our command.

The best instrument to test the hearing of *noises*, is a watch. A ticking clockwork might be made for this purpose alone, and used by aurists as generally as Snellen's or Jäger's test types by oculists, which would bring uniformity into our examinations. I leave that to our colleagues in Germany and Switzerland. Until then every aurist will have to use his watch the hearing distance of which he knows. My watch is heard, in my consultation-room, by the majority of people between

30 and 45 years of age, at a distance of *ten feet* from the ear. If a person hears this watch at 10′, I denote his hearing power for noises $h=\frac{10}{10}$, *i. e.*, 1, or normal.*

Children, as a rule, hear more acutely than adults, and frequently have $h=\frac{15}{10}$; while people over 50 rarely exceed $h\ \frac{3}{10}$ to $\frac{8}{10}$. This shows that the acuteness of hearing at different periods of life varies more than the acuteness of sight. If we bear that in mind, the above expression will give us a correct notion of the degree of the impairment of hearing.

If a patient hears a watch of 10′ normal hearing distance at 2′, his hearing is only one-fifth of the normal standard, but instead of writing it $h=\frac{1}{5}$, it is preferable to write $h=\frac{2}{10}$, because this at the same time shows how the value was obtained, and can be read in the words at the beginning of this sentence. I prefer to use the numbers in such a way that they not only show the fraction of hearing acuteness, but also the mode of examination; for instance, if the watch is heard only at 1 inch, I write $h=\frac{1}{12.10}$, and do not reduce the fraction to its simplest expression, or if I do, I place it after the unreduced fraction; for instance, $h=\frac{3}{12.10}=\frac{1}{40}$, which shows that the patient whose hearing acuteness for

* Being accustomed to use the letter "*H*" for hearing power in general, I formerly expressed the hearing of noises, the voice, and music with indices as *Hn*, *Hv*, and *Hm*: Dr. Prout uses *H* (horologium) for the watch, *V* (vox) for the spoken voice, and *V. S.* (vox susurrata) or simply *S* (susurrus) for the whispered voice. He uses moreover the following abbreviations: *P. A.*, potentia auditus, for hearing power, *A. D.* and *A. S.*, auris dextra and auris sinistra, for right ear and left ear, and expresses the hearing distance in inches. This gives longer formulæ than is necessary. For the sake of brevity I have adopted two of Dr. Prout's abbreviations, *h* instead of *Hn*, and *v* instead of *Hv*; *s* is unnecessary, but *m* for *Hm* has to be added.

noises is $\frac{1}{40}$ of the normal standard, hears a watch of 10′ hearing distance at 3″. Fractions of an inch I place either in the numerator, as $h=\frac{1\cdot 2}{12\cdot 10}$, or leave only the unit in the numerator and place all the other numbers in the denominator, as $\frac{1}{2\cdot 12\cdot 10}$; both of which show at once that the watch is heard at half an inch. If a patient hears the watch only in contact with the auricle, I record it $h=\frac{1}{\infty}$, and if he does not hear the watch at all, it is $h=0$. For the right or left ear, the initials *r* and *l* are added. The terms $r\ h=\frac{6}{12\cdot 10}=\frac{1}{20}$, $l\ h=\frac{1}{3\cdot 12\cdot 10}=\frac{1}{360}$, etc. will now not only be easily understood, but read in the usual phraseology.

The determination of the acuteness of hearing the *voice*, which we shall denote by the letter *v*, is of the greatest practical importance. *V* cannot be ascertained with the same uniformity as *h*, but by some attention it may be tested with sufficient accuracy for all practical purposes. We have to distinguish *whispered* and *spoken* voice. I have practised *whispering* so loud—and no louder—that persons with healthy ears understand it at a distance of *twenty* feet (the length of my consultation-room). Moreover, I have found when I speak moderately loud in my consultation and waiting rooms, that I am understood by people with normal hearing at a distance of *sixty feet.* Every physician may, by some practice, graduate his whispering and spoken voice in such a way, that he can use it as a test for the sharpness of hearing adapted to his own consultation-room. He will also soon learn what words are more easily understood than others, and take this into account in estimating the hearing power of his patients. Moderately loud

whispering being understood at the distance of 20′, and moderately loud speech at the distance of 60′, 20 and 60 in the denominator of the fractions expressing *v*, always mean whispering, respectively spoken voice. Examples:—

$v=\frac{20}{20}$ means whispering is heard at the normal distance;

$v=\frac{60}{60}$ means a person's acuity of hearing for ordinary voice is normal;

$v=\frac{3}{20}$ means that whispering which a healthy ear hears at 20′, is heard only at 3′;

$v=\frac{5}{60}$: the voice which should be heard at 60′, is heard only at 5′.

$v=\frac{1/2}{60}=\frac{1}{120}$: voice of 60′ hearing distance is heard at $\frac{1}{2}$′.

$v=\frac{1}{\infty}$ means quantitative perception of sound, that is, the patient hears the voice, but is not able to understand words.

$v=0$: no voice is perceived.

In testing *v*, I follow the customary rules: the patient turns his ear towards the speaker, closes the other ear, and repeats the words.

To test the acuteness of hearing for musical sounds *m*, I use a small musical box,* the sounds of which are heard by a healthy ear 80′ distant. It is hardly necessary for me to give examples for its use: $m=\frac{10}{80}$ means a musical box the tune of which is normally heard at a distance of 80′, is heard at 10′; $m=\frac{1}{\infty}$ means quantitative

* The smallest I could find, playing two tunes, the notes of which are of a high pitch, a condition not unimportant.

perception of musical sounds, but no tones or melodies are distinguished; $m = 0$: no musical sounds at all are perceived.

I need hardly add that in testing the hearing power for any quality of sound, the test object has at first to be held far off and gradually approached until it is distinctly heard; this distance is recorded. Going in the opposite direction, removing the test object from the ear till it is no longer heard, we obtain greater and less uniform values, which is in accordance with the law of the acuteness of all perceptions. As I use the letter H for hearing in general, $H=0$ means absolute deafness, and $-H$ may be an abbreviation for diminution, impairment, or hardness of hearing.

The method above described of testing and recording the acuteness of hearing is analogous to the determination of the acuteness of sight; it would seem to answer the purposes of the aural practitioner; it is certainly comprehensive, and saves a good deal of writing; advantages which, I trust, make it worthy of being submitted to the profession.

ON THE TREATMENT OF SOME EYE DISEASES BY MEANS OF THE CONSTANT CURRENT.

By Dr. DRIVER, of Chemnitz.

Translated by Dr. C. C. Terry, of New York.

If we may judge from the scanty contributions upon the use of the constant current in eye diseases, it would appear that galvanism as a therapeutic agent has not won extensive favor amongst the oculists. It is, on this account, my purpose in this place to recommend to my colleagues, in the warmest terms, a remedy, which the more I have used it in opportune cases has given the more surprising results, and to give from my somewhat extended experience some hints as to the method of using it; for, as is well known, electrotherapy depends mostly upon the method.

I employ in the treatment of eye disorders the constant current only—for the induction current, although so valuable in other diseases, has in my hands, though often tried, never shown a trace of effect,—and the apparatus I use is the so-called hand-plate battery with carbon-zinc elements of Dr. Stöhrer, of Dresden.*

* This plate-battery with a contrivance for raising and immersing the plates, a sliding bar to combine them, and a commutator, unites cheapness—which is a matter of some importance—with transportability. If used on an average six times a day, it preserves its constancy during several months. No rheostat is necessary for eye disorders. For reophores I use pieces of sponge moistened with solutions of salt, that for the anode being larger than that for the cathode.

The application may be made in three ways, according to the kind and seat of the disorder: *a*, through the head, either longitudinally:—anode on nucha and cathode on the right or left frontal protuberance, or transversely:—anode and cathode on each temple or both mastoid regions; *b*, galvanization of the sympathetic on one or both sides; anode on nucha and cathode on region of upper cervical ganglion, *i. e.*, the angle of lower jaw; *c*, locally on the eye; anode on nucha and cathode on the closed lids. The anode is always stable, but I prefer the cathode unstable. Duration of a sitting usually 1–2 minutes. Number of elements as required; as a general direction it should be remarked that in no case should there be pain or dizziness *during* or headache *after* the sitting. Generally 6–8 elements suffice for the head, 6–14 for the neck.

The diseases in which the constant current is recommendable are the following:—

I.—*Neuroretinitis in consequence of cerebral processes —neuroretinitis symptomatica.*

After Sesemann's account of the course of the orbital veins (Archiv f. Anat. u. Phys., 1869, No. 2) we must cease to refer that one of the varieties of neuroretinitis formulated by v. Graefe (Archiv f. Ophth. vii. 2 and xii. 2), called by him "congestion-papilla," to increased intracranial pressure, and thereby induced compression of the ven. ophthalmica. It is much better, after the example of Benedikt (Electrotherapie, p. 253), to consider the circulatory alteration as dependent in most cases upon a disordered innervation of the sympathetic,

caused by the cerebral process, and to seek accordingly to restore the circulatory equilibrium in the brain by galvanization of this nerve. The results which this method has usually accomplished, at least in recent cases, greatly favor Benedikt's theory, and in most cases are recognizable in a few days, both by the ophthalmoscope and by the examination of the central and peripheric visual acuteness. The dizziness also, the headache, the attacks of sudden blindness, and the occasional paralysis of the ocular muscles usually cease, and even the course of the cerebral process—tumor, softening, etc.—appears to be favorably affected by the galvanization of the sympathetic and the lethal termination delayed.

I galvanize the sympathetic daily, either on both sides —since this affection is always bilateral—or on the side which is sensitive under pressure.

I refrain from citing a series of selected cases, but will mention one at present under treatment.

Mrs. Roscher, of this place, 26 years old, somewhat anæmic, was attacked with bilateral neuroretinitis the second time, three weeks ago; the first attack occurred about a year ago, shortly after a colleague had operated on her for a colossal tumor, during which operation there was severe hemorrhage. Both papillæ were moderately swollen and veiled, veins very full and tortuous, arteries very thin, consequent amblyopia of such a degree that the patient had to be led; occasionally total blindness, dizziness, headache, anorexia, vomiting, fainting, all as in the first attack; but no paralysis. Besides repose in a darkened room, the treatment adopted was daily galvanization of the sympathetic nerves, of which the left was particularly sensitive to pressure. To-day, the nineteenth of treatment, the condition is as follows: S= $\frac{20}{30}$, with peripheric visual field normal, but with a lack of persistency;

for although at first No. 20 Snellen could be seen at 20′, presently only No. 40 could be recognized; the ophthalmoscope showed no trace of anomaly in either retina or papilla. Treatment now: iron and the constant current.

II.—*In amblyopia without ophthalmoscopical anomaly, as also in amblyopia ex abusu spirituosorum seu nicotini, in amblyopia congenita and amblyopia ex anopsia the results are less encouraging.* Still, I will make further trials. In these cases it would be advisable mostly to use the current through the head as through the optic nerve. I am sorry to say that strychnine injections, with which I experimented long before Nagel's recommendation, have yielded no better results.

III.—*Atrophy of the Optic Nerve.*

Where the atrophy, occasioned by a neuritis descendens, or appearing after a cerebral or medullary disease, has been for a long time stationary, and also where there is absolute amaurosis, I have never accomplished a permanent relief by the constant current. On the contrary, however, in all cases of primary pure atrophy in patients of otherwise good physical and psychical condition, I have undertaken longer courses of galvanism, and it was only in the rarest cases that there was no improvement, while in many it was considerable, and in some astonishing—often in a short time. The treatment consisted in the conduction of the current through the head, especially the direct galvanic excitation of the optic nerve. Notwithstanding Benedikt's repeated arguments, I cannot agree with him in the opinion that the galvanic excitation of the optic

nerve is entirely due to a reflex irritation of the sensitive fibres of the trigeminus, but must rather affirm, with Erb, who has strenuously opposed this theory in behalf of the acoustic nerve (these Archives, II. 1.) with Landsberg (Arch. f. Ophth., XI., 1. p. 69), and others, not only the possibility of a direct irritation of the nerves of special sense, but also the firm conviction that I must ascribe the excellent results which I have obtained in atrophy of the optic nerve solely to the difference of my method of galvanizing from that of Benedikt, viz., to the direct irritation of the optic nerve through the closed lids.

The possibility and probability of an improvement, or at least an inhibition of the process, may be assumed whenever the disease has not yet reached its ultimate condition either by total blindness or long persistency in the same bad state. But, especially where there are spontaneous fluctuations of the visual field and acuteness should the galvanism be continued, even if at first the improvement is scarcely perceptible. The desperate situation of such patients—often still youthful—may encourage the physician in patient effort.

From my pretty extensive observations upon the results of the constant current in atrophy of the optic nerve I will cite but a few cases, the first of which is still under the treatment of one of my colleagues.

Teichmann, teacher, of Zettlitz, in Saxony, came to me first on the 14th of June, 1870. He was a robust, intelligent man of 24 years, and he described to me very minutely the affection from which he had suffered for years. He first sought relief at Leipsic, where, it appears, a good prognosis was made in the beginning. He received a corrobora-

tive treatment which was discontinued to allow him to return home and get rid of a tape-worm which had long troubled him. The successful remedy appears to have been of an energetic character, but it exerted no beneficial influence upon the course of the eye disease; on the contrary, sight constantly diminished. In his distress he went to Berlin and sought Prof. v. Graefe, in whose clinic he was treated during six weeks with Heurteloup's leech. Still the sight diminished, and then he fell into the hands of a Berlin homœopathist, P——, who kept him in his institute for some weeks and treated him with injections (?) and consolation—but all to no purpose.

The examination of the patient at his first visit discovered: exquisite atrophy of both optic nerves with shallow excavation of papillæ; veins and especially arteries hair-like and traceable only for a short distance towards the periphery; slight strabismus divergens of left eye with eccentric fixation; continual nystagmus—like movements of both bulbs. With myopic glasses $\frac{1}{24}$ central vision was, in bright daylight, right, fingers at 4′, left, only at 3′; peripheric field so contracted that the patient felt as though he looked through a tube; Daltonism. Visual acuity had lately diminished to such a degree that the patient must be led about. As I was at that time experimenting with strychnine injections I subjected this patient to that treatment during three weeks, but with no other result than that he got no worse. Then I commenced with the constant current, and the result was wonderful. On the 27th of July the patient found his way alone. In two months he could count fingers with either eye at 20′, fixed centrally with the left alone or with both, and there was no trace of the strabismus. I had a galvanic battery prepared for him, instructed him in its use, and dismissed him with the direction to continue the treatment a year, with intervals. He came to me every two or three months, and each time an improvement was apparent. At the last examination, Nov. 4, 1871, he read Snellen No. 8, and recognized all the colors. The atrophy of the optic has not disappeared, but there is a rosy-red blush over the papilla, and the vessels, especially those on the right side, which were formerly the better, have recovered considerable of their calibre, though still not normal, and are traceable to the periphery. Although it can be hoped only to approximate to the normal visual acuity, I believe that the improvement, though tedious, will continue for a long time.

A second case, which I may cite, is the following:—

Mrs. Harz, from Straken, near Leipzig, 45 years old, received May 23, 1871; suffered a good while from amaurosis of the left eye. Latterly, especially since the care of her sick husband obliged her to be awake much at night, she sees something like a mist before the hitherto sound right eye. The patient is strong and healthy, excepting what a gynecologist of this place pronounces granulations of the mouth of the womb. The ophthalmoscope discovers an exquisite atrophy of the left optic nerve. In the right eye, only the first stage; the papilla somewhat whiter than normal, and the vessels smaller. In an otherwise healthy eye these appearances would perhaps escape special attention, but in view of the circumstances I felt justified in diagnosticating atrophia n. optici incipiens. S=$\frac{20}{20}$, right peripheric field normal, no color blindness. After three weeks' treatment with galvanism, right S=$\frac{20}{20}$, mist cleared away, no suspicious appearance at the fundus, vessels wider, papilla normal coloration. On the left side, finger at 2′ above and outwards. She was discharged with instructions to return as soon as any bad symptoms should appear.

Sept. 17. Returned with S. scarcely $\frac{20}{30}$, and the mist has reappeared. Twelve days of galvanic treatment effected a cure.

In both the above-mentioned cases nothing but the constant current was used. Only, by way of experiment, a thread seton was put into the temple near the left eye.

The following case shows the effect of the constant current after all ordinary means had been exhausted:—

Mr. Eisenstuck, a very robust septuagenarian, of this place, exhibiting no trace of tabes, blessed with good sleep and appetite and a clear mind, has been for a long time almost blind of the right eye in consequence of sclero-choroiditis posterior with atrophy of the papilla.

April 11, 1871, he came to me on account of defective sight on the left side. Examination: slight swelling of the papilla optici with circumscribed staphyloma posticum, dilatation and tortuosity of the veins,

arteries thin; with myopia $\frac{1}{10}$, S=$\frac{20}{200}$; peripheric field of vision entire, and no color-blindness. Before having recourse to galvanization, trials were made with strychnine injections, sublimate, iodide of potassium, Heurteloup, Turkish and hot sand-baths, but nothing was gained except that the baths appeared to give some comfort. Then from the 1st of June galvanization was applied through the head and locally through the lids. On the 13th of July, 1871, patient was sent out with S= Snellen No. 4, at 6″, and directed to a North Sea bathing place. On his return his condition was the same. On the 20th of October the patient reappeared with sight diminished to Snellen No. 11 at 4″. The ophthalmoscopic examination discovered atrophy of the optic nerve. Galvanization of the eye, and, for experiment, of the left sympathetic nerve. On the 8th of November, after hardly three weeks of treatment, and notwithstanding the atrophy, the patient read Snellen No. 4 at 6″.

The hopelessness of every other kind of treatment in white atrophy of the optic nerve—excepting what may be expected from strychnine—and the effects of the constant current in this disease authorize me to urge further trial. I could add many more cases similar to the above; but I must not neglect to mention that in a number of cases I have made numerous applications without the slightest benefit. The constant current is indeed no sovereign remedy, and so far my utmost endeavors have not enabled me to discriminate at the commencement of treatment those cases which are likely to prove intractable. In spite, then, of some failures, one must not lose patience, but rather persevere; since, with a little practice, the application of the constant current, at least in eye diseases, is easy and does not waste much time.

IV.—*Affections of the Ocular Muscles.*

In regard to the galvanic treatment of paralysis of any or all the motor nerves of the ocular muscles, so exhaustively considered by Benedikt (Elektrotherapie and Archiv f. Ophth. x. 1.) and Erb (these Archives, ii. 2, p. 228), I need only say that my results have been quite as favorable as theirs. But I prefer the direct irritation of the affected parts to the indirect reflex action *via* the trigeminus. For a long time I have used the method of Erb: anode stable on the nucha, or behind the ears, cathode unstable upon the closed lids in the region of the affected muscles. In peripheric paralysis I think we can dispense with galvanization of the sympathetic. But if the paralysis is of central origin, as, for instance, in syphilitic cerebral affections—of which I have lately treated and cured a number of cases, mostly unilateral paresis of the abducens or trochlearis—I lay considerable stress upon this manipulation. Rheumatic paralyses are relieved usually in eight days, often in less time. Less than a week ago, I cured a rheumatic paralysis of the right abducens in a single sitting.

Erb has found that mydriasis with or without coincident paresis of accommodation is very obstinate, but such has not been my experience. I remember only one case, of 20 years' standing, which resisted my persistent galvanic treatment. In mydriasis I apply the anode on the nucha, and with the cathode make circular movements over the closed lids, as advised by Benedikt. Some effect is apparent immediately after the sitting,

diminishes somewhat until the next, but gradually becomes permanent. The cure is often surprisingly quick. In the case of a woman at present under treatment with mydriasis and paralysis of accommodation together with paralysis of the abducens and strabismus convergens paralyticus on the same side, the first-named affection yielded in a few days without calabar, but the paralyzed abducens has not yet recovered.

Hitherto I thought electricity unnecessary in myosis, for in all cases atropine is easier of application and its action is more durable.

Ptosis, without coincident paralysis of other branches of the oculomotorius, resists the galvanic treatment, and in this disorder I have accomplished but little, without being able to give a reason for the failure. Old cases of intermittent blepharospasmus are equally obstinate. Concerning this, Seeligmueller of Halle has published an interesting account in the August number, 1871, of the "Klinische Monatsblätter." In most of the cases I have been able to make some improvement, but it did not last. Thus in the case of a thin old lady with a great number of "pressure points," each application of the cathode to some of the points gave several days' relief, but there appeared at the same time such severe pain in the head that I was obliged to relinquish the galvanic treatment. A subsequent section of the left supra-orbital nerve gave relief for only eight days, although there was complete anæsthesia of that part of the forehead which was supplied by the divided nerve.

I have used galvanism extensively in cases of *insufficiency of the recti interni*, and with brilliant results.

Here I apply the galvanism locally only, at the inner angle. Without relating different cases in detail I will mention that of a gentleman lately discharged from treatment, who had the habit for years of closing the right eye while reading, and who was unable to give an account of the origin of the habit. Some months ago he was attacked with mydriasis and paresis of accommodation in the left eye, for which affection he consulted me. In this case I thought it advisable to have recourse to calabar in order that the patient, who was confidential clerk in an extensive business, might immediately return to his duties. At the same time I proposed galvanism for the insufficiency so long ignored, and, eventually, the quicker to accomplish the purpose, tenotomy of the corresponding externus. After Prof. Coccius of Leipsic, whom he once consulted, had advised him not to be operated on, I continued the galvanic treatment. At the commencement of the treatment the insufficiency was so considerable that a proper convergence for binocular vision at a short distance could be maintained only for a few seconds. The attempt to thus fix the eyes caused such a wide divergence of the mydriatic left eye that a disagreeable strabismus resulted. After about two months of almost daily galvanization, addressed at first to the mydriasis which yielded speedily, the otherwise emmetropic patient could fixate by the hour, and found it necessary only occasionally in the evening to close the right eye. Landsberg (Arch. f. O. xi., 1.) is quite as much in favor of galvanism for insufficiency, and he reports minutely a series of cases which I should merely copy were I to relate my own.

V.—There remains to be mentioned an affection, only three cases of which have fallen under my notice, and only the last of which I treated by means of galvanism—*herpes zoster ophthalmicus.* But the effect of the constant current was so brilliant—not especially on the general course of the disease, but upon the accompanying pain—that I do not hesitate to invite further trial. At the last Heidelberg Conference Nagel expressed himself similarly.

VI.—Some time ago the electrolytic action of the constant current was extolled—I do not recollect by whom—in the treatment of *maculæ and leucomata of the cornea.* My numerous experiments with its variously modified use have given no better result than the other methods of treatment—merely negative, and the application is so painful that I have abstained from further attempts. I connected the anode with a probe-pointed sound with which I touched the spots, or penetrated into the leucoma with a gold acupuncture needle which was afterwards charged. Nothing was gained.

I have lately extended my experimentation with the constant current to inflammation of the cornea, especially to phlyctenular form accompanied by considerable photophobia, and I hope to be able soon to report satisfactory results.

CHEMNITZ, November, 1871

ON THE TREATMENT OF ULCUS CORNEÆ SERPENS.

By Dr. NIEDEN,

Assistant Surgeon to the Ophthalmic Institute at Bonn.

Translated by Dr. A. Schapringer, of New York.

The operative treatment of this disease as it has been recommended by Prof. Saemisch in his paper on *Ulcus corneæ serpens*, published at the end of the year 1869, has been largely introduced into practice and has proved successful wherever the execution of the proceeding was confined to characteristic forms, and its details, as given by the author, were strictly adhered to, of which I have satisfied myself both by published and verbal communications. It would seem superfluous, therefore, to speak again of this matter; I will make a few remarks, however, upon those cases that have since been treated in the clinic of Prof. Saemisch, because this form of disease has been confounded with others, and the operative procedure thus performed where it was not advised.

In the following table only 50 out of 80 cases are recorded, the history of the remainder being incomplete. Three of the latter were so far relieved by the first operation that they discontinued further treatment, and in the other 27 cases the results were corneal specks, but as the notes taken from their history are somewhat defective, no use has been made of them in compiling the following statistics:—

No.	Name.	Sex.	Age.	Eye affected.	Form of Disease. Complications.	Days prev. to treatment.	Etiology.	How often slit.	Day when the ulcerative process stopped.	Duration of treatm't. Days.	Results. Papillary margin.	Results.
1	Seb. Schwalb.....	m.	23	L	Ulc. corn. serp. c. hypopio, 1½ mm. diam	4		2	2	7	free.	Nubec. corn. Reads Jaeg. No. 2.
2	Wilh. Faulenbach....	m.	69	R	Ulc. c. c. hyp. Hor. diam. 5 mm., vert. diam. 4 mm. Total infiltr. Dacryocystobl. Glauc. abs. oc. sin.....			*1	3	21		Leucom. adh.
3	Cath. Dieffenbach...	f.	31	L	Ulc. serp. c. hyp. Diam. 1½ mm.....	8	Trauma.	9	2	15	free.	Nubec. corn.
4	Ad. Fallenbach.....	m.	36	R	Ulc. c. c. hyp. Infiltr. corn. Sten. duct. naso-lachrym. Pannus trach.....			4	2	14	free.	Mac. corn.
5	Jacob Eltzer.....	m.	50	L	Ulc. serp. c. hyp. Diam. 3 mm.....	14	Trauma.	12	3	30	free.	Mac. Hor. diam. 3 mm., vert. 2½ mm. Reads Jaeg. No. 5.
6	J. Darkew.....	m.	42	L	Ulc. corn. c. hyp. Diam. 4 mm. Infiltr. tot.....	5	Trauma.	10	2	14		Leuc. adh. S = ⅓.
7	C. Bollig.....	f.	37	L	Ulc. serp. c. hyp. Diam. 5 mm. Iritis serosa and Phthisis b. d.	5		14	3	27	free.	Mac. Reads J. No. 7.
8	W. Schmitz.....	m.	44	R	Ulc. serp. without hyp. Diam. 4½ mm.....	8	Trauma.	6	2	33	free.	Mac. J. No. 8.
9	G. Schmidt.....	m.	33	R	Ulc. serp. c. hyp. Diam. 4 mm.....	2	Trauma.	7	2	30	free.	Mac. J. No. 9.
10	M. Stürzel.....	f.	65	L	Ulc. c. c. hyp. Inf. Phthisis bulbi dextri.....			5	2	20	free.	Mac. Horiz. diam. ¾‴, vert. 1½‴. Counts fingers at 5-6′.
11	Hubert Epperstein ..	m.	26	L	Ulc. serp. c. hyp. Blepharitis ciliaris.....			6	2	12	free.	Mac.
12	J. Jungblicher.....	f.	68	L	Ulc. serp. c. hyp. Dacryocystobl. Phthisis bulbi dextri.....	14		4	2	21		Leuc. adh.
13	Caec. Fuchs.....	f.	60	L	Ulc. serp. without hyp. Diam. 3 mm.....	8	Trauma.	7	2	23	free.	Mac.
14	Jacob Müller.....	m.	62	R	Ulc. serp. without hyp. Diam. 5½ mm.....			5	2	†		

* Aqueous humor escaped spontaneously afterwards.

† Discontinued treatment. Prognos. good.

No.	Name.	Sex.	Age.	Eye affected.	Form of Disease. Complications.	Days prev. to treatment.	Etiology.	How often slit.	Day when the ulcerative process stopped.	Duration of treatment. — Days.	Results. Pupillary margin.	Results.
15	Joh. Rechtfeld	m.	78	R	Ulc. serp. c. hyp.	14		7	2	23	free.	Mac.
16	A. Graw	f.	33	R	Ulc. corn. c. hyp. Hor. diam. 7 mm., vert. d. 4 mm. Tot. infiltr.	14		6		‡		
17	El. Heinen	f.	68	L	Ulc. serp. c. hyp.		Trauma.	9	2	26	free.	Mac. Counts fingers at 12′.
18	J. Buchholz	m.	39	L	Ulc. corn. c. hyp. Diam. 5⅓ mm. Infiltr.	30		12	2	32		Leuc. adh.
19	T. Schneider	f.	46	L	Ulc. serp. c. hyp. Phthisis bulbi dextri	7		7	2	42	free.	Mac. Diam. 4⅓ mm. J. No. 9, sten. No. 2.
20	Joh. Bungs	m.	38	R	Ulc. serp. without hyp. Diam. 5 mm	7	Trauma.	15	2	27	free.	Nubec. J. No. 5.
21	Marg. Stoll	f.	52	L	Ulc. serp. without hyp. Diam. 5¼ mm. Dacryocystobl.			9	2	26	free.	Mac.
22	Anna Schneider	f.	66	L	Ulc. serp c. hyp. Hor. diam. 4⅓ mm., vert. d. 5⅓ mm. Sten. duct. nasol.	8		2	2	26	free.	Mac.
23	Franz Kitz	m.	48	R	Ulc. corn. c. hyp. Diam. 6⅓ mm. Total infiltr. Phth. bulb. d.	14			20	§		Leuc. adh.
24	Ursul. Münich	f.	65	R	Ulc. serp. c. hyp. Diam. 5 mm. Chron. conj. catarrh.	8	Trauma.	2	2	†5		
25	M. Scharf	m.	55	L	Ulc. serp. c. hyp. 3⅓ mm. Hor. diam. 1⅓ mm.	14	Trauma.	5	2	30	free.	Mac. Vert. diam. 3 mm. J. No. 3.
26	M. Schmitz	f.	43	L	Ulc. serp. c. hyp. Diam. 5 mm. Dacryocystobl.	14		2	2	30	free.	Mac.
27	Ch. Velten	f.	61	L	Ulc. corn. c. hyp. Diam. 6 mm	14		9	2	26	free.	Mac.
28	W. Jung	m.	59	L	Ulc. corn. c. hyp. Diam. 4 mm. Parac. without success. Infiltr.	14		5	2	18	free.	Mac.
29	Carl Maurer	m.	48	R	Ulc. c. c. hyp. Infiltr. Hor. diam. 7 mm., vert. d. 5 mm.	14		2	2	28		Leuc. adh.

30	Peter Blumenthal ...	m.	56	L	Ulc. c. c. hyp. Inf. Hor. diam. 5 mm., vert. d. 3 mm.... ...	21		*3	1	21		Leuc. adh.
31	Cl. Schüller	m.	43	R	Ulc. serp. c. hyp.....	14	Trauma.	2	2	30	free.	Nubec.
32	Joh. Schneider.....	m.	59	L	Ulc. serp. c. hyp.....	8		6	3	30	free.	Mac.
33	Geb. Reiserath.....	m.	46	R	Ulc. serp. c. hyp.....	5	Trauma.	5	2	15	free.	Nubec.
34	M. Heumann.....	m.	69	R	Ulc. serp. c. hyp. Diam. 3 mm Dacryocystobl. Phth. bulb. sin	14		4	2	21	free.	Nubec.
35	Mich. Zinner.....	m.	34	R	Ulc. serp. c. hyp. Diam. 3 mm. Dacryycystobl.....			8	2	20	free.	Nubec. J. No. 4.
36	Peter Brühl.....	m.	44	L	Ulc. serp. without hyp.....	12	Trauma.	3	2	30	free.	Nubec.
37	Marie Seltzer.....	f.	50	R	Ulc. c. c. hyp. et infiltr.....			4	2	15	free.	Nubec.
38	Anna Krupp.....	f.	26	R	Ulc. serp. c. hyp.....	8	Trauma.	10	2	12	free.	Nubec. S= ⅛, J. No. 7.
39	M. Birschen.....	f.	56	R	Ulc. serp. without hyp.....		Trauma.	6	3	30	free.	Mac.
40	Fried. Culm.....	m.	45	R	Ulc. serp. c. hyp. Diam. 2 mm	8	Trauma.	5	2	11	free.	Nubec. S = ⅛, J. No. 4.
41	C. Rodemacher.....	f.	19	R	Ulc. serp. c. hyp. Diam. 2½ mm	22	Trauma.	7	2	33	free.	Nubec. S = ⅛, J. No. 1.
42	M. Schmitz.....	f.	33	R	Ulc. c. c. hyp. Infiltr. Diam. 4 mm. Dacryocystobl.....			3	2	32		Leuc. adh.
43	C. Weber.....	f.	57	R	Ulc. serp. c. hyp. Diam. 4½ mm. Dacryocystobl	14		3	2	35	free.	Nubec. J. No. 3.
44	M. Hugot	f.	49	L	Ulc. serp. c. hyp. Diam. 4½ mm. Iridocycl. Phthisis bulbi dext.....	6	Trauma.	5	2	36	free.	Nubec. S = 1-10, J. No. 5.
45	E. Jost.....	f.	43	L	Ulc. serp. c. hyp. Diam. 4½ mm. Dacryocystobl.....	14		5	3	33		Leuc. adh.
46	M. Hermann.....	m.	70	R	Ulc. serp. c. hyp. Diam. 1 mm. Dacryocystobl. Phthisis bulbis.	14		4	2	17	free.	Nubec. J. No. 4.
47	H. Hortenbach.....	f.	55	R	Ulc. corn. c. hyp. Diff. infiltr. ¼ of cornea. Dacryocystobl.			*1	2	30		Leuc. adh.
48	Peter Evens.....	m.	17	L	Ulc. serp. c. hyp. Diam. 3 mm.....	8	Trauma.	10	2	30	free.	Nubec. S = ¼, J. No. 3.
49	Jac. Heinscheidt....	m.	47	R	Ulc. serp. c. hyp. Diam. 3 mm. Dacryocstobl.....	8		3	2	27	free.	Nubec. S = ¼, J. No. 3.
50	Reutzer.....	f.	50	L	Ulc. corn. c. hyp. Diff. inf. Diam. 4½ mm. Iridocyclitis and dacryocystobl.....	8		15	3	30		Leuc. adh.

* Aqueous humor escaped spontaneously afterwards.
‡ The ulcerative process could not be stopped. Phthis. ant.
† Discontinued treatment. Prognos. good.
§ Ulc. process at times regressive, at others progressive.

Of the cases recorded, there occurred in the age between 70–80 (2), 60–70 (10), 50–60 (11), 40–50 (13), 30–40 (9), 20–30 (3), and between 10–20 (2) cases. The largest number in proportion to the number of living individuals were between the ages of 60–70.

As to the sex of the patients, 27 out of 50 were males, 23 females, the latter being only 8 per cent less. This ratio might well have been anticipated, since the females of the poorer class are nearly as much exposed to injuries that give rise to a great number of these ulcers as the males. An injury was the origin of this disease in 19 cases, or 38 per cent.; there was usually a bruise of the cornea, or an irritation caused by a foreign body lodged for some time in the conjunctival cul-de-sac, and which rubbed against the cornea.

Since, in the majority of cases, statistics show that the left eye is injured, it would seem strange that we found the right eye as often diseased as the left. This apparent disproportion is explained by the fact that dacryocysto-blennorrhœa and stenosis of the lachrymal duct establish a predisposition to the formation of suppurative corneal ulcers, as is here shown in 15 cases, that is, in 30 per cent. where the right side was affected in 9 cases, the left only in 6. Whereas a greater number of ulcers produced by injuries occurred in men, complications, with diseases of the lachrymal duct, were more frequent in women—in the ratio 9 : 6, that is, 18 per cent. : 12 per cent.

It is remarkable that in 9 cases, or 18 per cent, the other eyeball was found to be shrunken, the result, as it was stated, of a similar ulcer. This seems to prove that these ulcers not only attack eyes during senile met

amorphosis, but generally such as offer the least resistance to injurious influences.

The ulcers occupied, without exception, the centre of the cornea, none being found at the periphery. Abscesses, inflammatory and torpid infiltrations of the cornea, were excluded, as already stated. However, only in 36 cases, or 72 per cent., characteristic serpent ulcers were found, viz—a grayish opacity, situated in the superficial or deeper layers of the cornea, according to the stage at which the process had arrived, in which there was a loss of substance; the base of the latter uneven, and covered with particles of sloughed tissue. The region of proliferation was white, semi-circular, and prominent; sometimes there was a furrow throughout its whole length, and in some cases it was divided into 3–4 semi-circular mounds. This was often surrounded by an infiltrated zone which, in its immediate vicinity, appeared as a striated opacity, whereas at some distance there was a more or less dense infiltration; in the first stage, the region of proliferation may be sharply defined from the normal corneal tissue. In three-fourths of the cases, ciliary neuralgia and symptoms of general irritation were present. Hypopyon is not a characteristic feature of the process, since it was missing in 8 cases, or 16 per cent., whereas irritation of the iris could be demonstrated in every case.

In two cases, that is, in 4 per cent., marked iridocyclitis was present. In 14 cases, or 28 per cent., when they came under observation, the ulcerative process was so far advanced that only a few, or even none, of the characteristic features of ulcus corneæ serpens were left,

as, owing to the large extent of destruction of tissue, the white mound of proliferation could no longer be traced, the grayish tint of the base was converted into yellowish white, and the ulcer had penetrated deeply into the corneal tissue; in almost all these cases there was iridocyclitis. This form has been termed ulcus corneæ c. hypopyo et infiltrat.

Out of these 50 cases, there were 28 per cent. ulcers with diffuse infiltration; 72 per cent. ulcera serpentia; 56 per cent. ulcera serpentia c. hypopyo; 16 per cent. ulcera serpentia without hypopyon.

Treatment.—As soon as it was ascertained, either immediately or after one day's observation, that the ulcerative process was still progressing, the whole base of the ulcer was slit in the following manner—no chloroform being administered:—The eyeball being steadied by the fixation-forceps, Graefe's knife was thrust into the anterior chamber through the healthy tissue of the cornea, on one side, near to the edge of the ulcer, and carried so far as its opposite edge, the counterpuncture being made in the normal tissue too. The fixation-forceps being taken away, the base of the ulcer was slit by gentle to-and-fro movements of the knife, the edge being directed straight forward.

The cut was always performed in such a way that it divided the edge of proliferation in its middle, or at least one segment of it. The aqueous humor escaped slowly from the puncture and counterpuncture, the hypopyon mingling with the last drops. The rest of the hypopyon, if any remained, was left, except when it consisted of fibrinous coagulations which protruded into

the wound, in which case they were removed by a pair of forceps. If the coagulations did not protrude, no effort was made to coax them out by gently rubbing the lids, but they were left in the anterior chamber to undergo absorption. Only in cases where the ulcer occupied a considerable part of the cornea, the cut was modified in such a way that only one end lay in normal tissue at some distance from the actual or the supposed place of the edge of infiltration, while the other end was located in the middle or more toward the margin of the ulcer, according to its dimensions.

Twice there occurred a sudden evacuation of the anterior chamber, yet no bad effects were noticed afterwards. Indeed, no untoward event occurred, even with unruly patients, and no evil consequences were observed. Most of the patients described the pain caused by the operation as rather trifling.

An hour after the operation, atropine was instilled, this being repeated 4-8 times a day, the patients being kept in bed on their back. Sometimes a light protective bandage was applied, but no compressive bandage. As long as the ulcer showed any tendency to progress, the cut was re-opened every day by Graefe's knife, sometimes by Weber's canaliculus knife, without fixing the eyeball, the patient lying on his back, the lids being kept apart by the fingers of an assistant. As to the time when the continuance of this treatment is no longer useful, no other indications were found than those given by Saemisch in the paper already referred to, viz.: the total disappearance of the zone of infiltration, the base of the ulcer being sharply defined, the mound

of the proliferating tissue having sunk to a level of the surface of the ulcer, a uniform grayish hue of the wound and of the base of the ulcer, the latter clearing up and all the symptoms of irritation of the eye having subsided. No general rule can be laid down as to the time when these symptoms make their appearance; however, later observations made in this clinic and that of Wiesbaden have shown, that it is commonly less than three weeks, which was said to be the average time in Saemisch's paper.

The average number of slittings performed was 6,4, as shows the following statement:

In 3 cases or 6 per cent. slitting was performed once,
" 6 " " 12 " " twice,
" 4 " " 8 " " 4 times,
" 8 " " 16 " " 5 "
" 5 " " 10 " " 6 "
" 5 " " 10 " " 7 "
" 1 " " 2 " " 8 "
" 4 " " 8 " " 9 "
" 2 " " 4 " " 10 "
" 2 " " 4 " " 12 "
" 1 " " 2 " " 14 "
" 2 " " 4 " " 15 "
" 1 " " 2 " " 20 "

In three cases the slitting of the ulcer was performed only once, the wound not closing afterward. In these cases the ulcer was combined with a diffuse infiltration of the cornea, one half or even three-fourths of the cornea having been destroyed, and the wound was necessarily very large. In six cases, the process was

completely arrested 36 hours after the first operation. In 8 cases, the largest number in the above statement, the ulcer was slit 5 times, this coming very near the average figure, which is 6,4.

Though it might have been anticipated that in old age the reparation of the ulcer, like all other vital processes, would go on very slowly, nevertheless, the cases occurring between the ages of 30 and 40 required the longest treatment, as shown by the following table. It shows the ratio of cases and slittings performed, the number of cases occurring between the ages of 70–80 as well as that of the slittings performed upon them, each being put = 1.

Age.	Cases	Slittings.	Age.	Cases	Slittings.
70–80	1,0	1,0	30–40	4,5	7,8
60–70	5,0	4,8	20–30	1,5	1,8
50–60	5,5	6,7	10–20	1,0	1,7
40–50	6,5	7,9			

Old age and the period of the most active development show here a remarkable coincidence.

More than one slitting was never done in one day. It was never necessary to make a crucial incision. In two cases the re-appearance of the ulcerative process made it necessary to slit a second time after the re-opening of the wound had been discontinued for some time.

The *results obtained* by this treatment as shown by our statement, may serve well to corroborate the observations published two years ago, that by this treatment the progress of the disease is immediately arrested,

and as much sight is preserved as is possible under those circumstances, and that the ciliary neuralgia ceases a short time after the commencement of the treatment, which, on an average, does not last longer than four to five weeks.

Our statement contains, however, two cases which were treated by this method without success. But these are exactly the same cases in which the ulceration was the most advanced; in one case the horizontal diameter extending to 7 mm., the vertical to 4 mm.; in the other case, having a diameter of 6½ mm., and the remainder of the corneal tissue which was not yet occupied by the ulcer being already infiltrated. The slitting was made here only as a trial, and the prognosis was considered as exceedingly bad from the beginning. In one case the result was phthisis anterior, the formation of a staphyloma being prevented; in the other, in which warm fomentations were made, the result was an extensive leucoma adhærens.

On the other hand, in 42 cases or 84 per cent. the progress of the ulceration was arrested by the first slitting, the same result being obtained in 6 cases or 12 per cent. by the second slitting; the ciliary neuralgia which was more or less severe, ceased at the same time in all these cases. The apprehension of the formation of anterior synachiæ which was formerly feared, was verified in those cases only in which the ulcerative process had extended so far that there was no hope for a cure without leucoma. In 70 per cent. the pupillary margin was absolutely free when the treatment was stopped.

The duration of treatment varied with circumstances so that an average time can scarcely be found. But in the main, patients could be dismissed from the hospital at the beginning of the fourth week, either cured entirely, or continuing treatment as out-door patients.

The results obtained are the following:—

In 2 cases or 4 per cent. failures.
" 2 " 4 " treatment discontinued.
" 11 " 22 " leucoma adh.
" 35 " 70 " nubeculæ or maculæ corn.

RESULTS CLASSIFIED

1) According to the age of the patients:—

Age.	Mac. per cent.	Leuc. per cent.	Failures. per cent.	Treatm. discon. per cent.
70—80	4	—	—	—
60—70	10	6	—	4
50—60	16	6	—	—
40—50	18	6	2	—
30—40	12	4	2	—
20—30	6	—	—	—
10—20	4	—	—	—

2) According to the form of the ulcer:—

a) of 28 per cent. diff. infil.
16 per cent. leuc. adh.
4 " failures.
8 " mac.

b) of 56 per cent. ulc. serp. c. hyp.
50 per cent. mac.
6 " leuc. adh.

c) of 16 per cent. ulc. serp. without hyp.
12 per cent. mac.
4 " treatment discontinued.

3) According to the sequels and complications:—

a) out of 70 per cent. nubec. corneæ there were

8 per cent. diff. infiltr.
12 " ulc. serp. without hyp.
16 " ulc. s. c. hyp. et dacryocystobl.
34 " ulc. s. c. hyp. without complic.

b) The 4 per cent. failures were all ulcers with diffuse infiltration.

c) In 4 per cent. the treatment was discontinued, but the prognosis was good.

d) out of 22 per cent. leuc. adh. there were

8 per cent. total infiltr. without compl.
8 " tot. inf. and dacryocystobl.
6 " ulc. s. and dacryocystobl.

If we compare these results with those obtained at the clinic of Zurich (M. Bukowa: Zur Hypopyonkeratitis. Diss. inaug. 1871), where the ulcer was sometimes treated by iridectomy, sometimes by slitting, but the latter with less satisfactory results, the treatment as it is pursued here appears to be far more advantageous:—

	Iridectomy, Zurich.	Slitting, Bonn.	Slitting, Zurich.
Phthisis bulbi.....	11.5 per cent..	4 per cent..	14.2 per cent.
Leuc. adh.....	24.6 " ..	22 " ..	40.5 "
Mac.....	57.4 " ..	70 " ..	45.3 "
Treatment discontinued	6.5 " ..	4 " ..	—

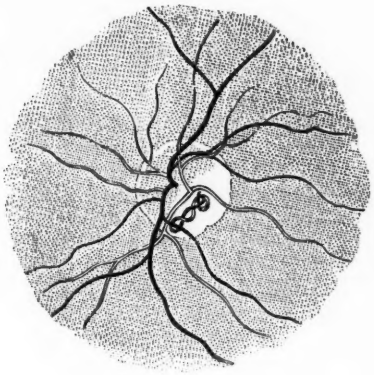
Bonn, December 18, 1871.

A CASE OF A PERSISTENT REMNANT OF THE HYALOID ARTERY.

By Dr. A. SCHAPRINGER, of New York.

Charles S———, æt. 11 years, suffers from asthenopia. Being examined with glasses, both eyes show hyperopic astigmatism = $\frac{1}{40}$, which being corrected, S proves to be = $\frac{20}{20}$.

On ophthalmoscopic examination, no abnormity can be found in the fundus of the left eye.



(ERECT IMAGE.)

In the right, a vascular loop, taking its origin near the centre of the optic disc, projects into the vitreous

in a direction forward and slightly downward. Its two branches, having the calibre of a main branch of the central retinal artery, emerge separately from the area of the disk, and are twisted round each other. Those portions of the loop, especially its apex, which cross the visual line of the observer at angles of about ninety degrees, appear bright red like the retinal arteries, while the other portions have a dark red color. The loop sends off no branches, and seems to occupy a firm position in the vitreous, as movements of the eyeball do not make it float.

With relaxed accommodation, the origin of the loop can be distinctly seen by an emmetropic observer with − 24, its apex with + 8, the real length of the loop, according to Knapp's table, (these Archives, Vol. ii., p. 397,) is therefore 1, 8 mm.

This case resembles closely that described by Dr. Charles J. Kipp in the present number of these Archives.*

The following extract from Von Ammon's paper on the Development of the Human Eye† refers to a loop of the arteria hyaloidea s. centralis fœtalis :—

"I call *ansa fœtalis arteriæ centralis* a loop which the central artery shows sometimes in its course through the *canalis hyaloideus*, before reaching the posterior wall of the lens-capsule . . . It . . . disappears gradually as the eye is growing in length, and has, perhaps, some relation to the subsequent atrophy of the artery. Here, too, much is left for further investigation."

* Clinical observations by Charles J. Kipp.

† Graefe's Arch. f. Opth., vol. iv., part 1, p. 221.

Whether the anomaly above described has any relation to this *ansa fœtalis arteriæ centralis* of Von Ammon, I do not know. So much, however, seems certain, that it is not a new-formed blood-vessel, but a remnant of the hyaloid artery.

A METHOD OF OPERATING FOR THE CLEFT LOBULE OF THE EAR.

By H. KNAPP.

In this country, where the women of all races wear ear-rings with more or less voluminous appendages, we are not infrequently called upon to unite fissures in the lobule. The text-books saying nothing about the removal of this little deformity, I presume that the simple union of the slit by a few sutures, after its edges have been freshened, is thought so natural a procedure as to require no special description. Yet its results, in a cosmetic point of view—which alone comes into question—may be rendered more satisfactory by the introduction of a little improvement in the operation. This improvement I borrow from the modern (*Mirault-Langenbeck*) operation for hare-lip. To avoid repetitions I shall describe the method from beginning to end.

If you have to operate on the left ear, let your patient recline to the right side, you stand behind his back, an assistant with his thumb and index finger seizes and stretches the anterior part of the cleft lobule, while you extend the posterior part, then thrust a Graefe's cataract knife or any narrow-bladed scalpel through the anterior part, near the lower end of the slit,

(at *a*, accompanying figure), sever a thin slice of skin along its edge; when arrived near the other end of the slit (at *c*), make the slice a little broader, leave its end (at *b*) in connection with the auricle, then turn the knife, go backward about two lines, and there cut across the detached slice (at *c*), thus forming a small flap. Now seize the long portion of the slice with a pair of forceps, and divide with the knife its other end (at *a*) by a slightly curved section. Without waiting long for the cessation of the bleeding, you may unite the edges of the wound

by three interrupted sutures. The first is applied to the middle of the anterior edges (indicated by two points in the drawing), the second, about opposite the first, to the posterior edges. The curved needles need not penetrate more deeply into the substance of the lobule than about one third of its thickness. By the

third suture the small flap (*cb*), left at the posterior part of the lobule, is made to bridge over the lower extremity of the gap. The needle, therefore, is first thrust through the free end (*c*) of the little flap, and then through the lower edge of the wound in the anterior portion of the lobule, the suture tied,—and the operation is finished. No dressing is required. In three days the sutures are removed. In every case thus operated on, have I obtained immediate union.

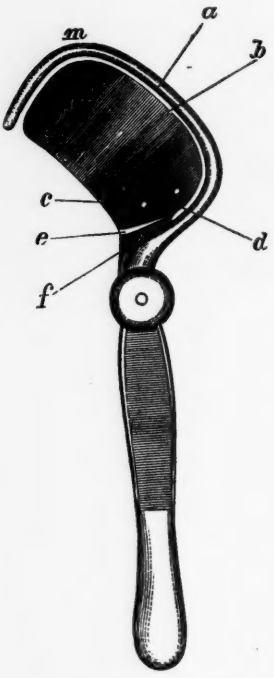
The procedure just described has the advantage that, by the adaptation of the little flap to the lower extremity of the wound, it restores the natural curved outline of the lobule, whereas operations without the formation of a flap, leave a notch.

AN IMPROVED LID-FORCEPS, ESPECIALLY FOR THE OPERATION OF ENTROPIUM.

By H. KNAPP.

The clamp-forceps which Dr. L. A. Desmarres (father) invented and described in his text-book (2d Ed. 1854, tome I., p. 602) under the name of *pince-anneau* or *pince fenêtreé pour l'extraction des kystes des paupières*, is a most convenient instrument for the removal of all kinds of tumors in the eye-lids. Snellen modified it by leaving off that part of the ring which corresponded to the free margin of the lid, and thus made it applicable to operations involving the palpebral edge,—for instance, the operations for distichiasis, trichiasis, and entropium. Snellen's modification may be still further improved by letting the ring *surround* the margin of the plate, instead of resting upon it. This idea suggested itself to me on observing that in the greater number of cases of entropium, the half ring of the clamp does not enclose all that part of the inverted lid on which we have to operate. If, in such cases, we employ Snellen's clamp at all, we can excise only a central portion of integument, muscle, and cartilage, then we have to remove the instrument in order to extend the wound toward the angles. Under those circumstances it is more expeditious to dispense with the clamp altogether, and use the old horn-plate from the beginning to the end of the operation. This defect of the clamp can be obviated by making the half-ring larger than the plate, so that, when the instrument is closed, the ring not only

surrounds the plate, but leaves a free space of about a millimetre in breadth between its inner margin (See *a.* in figure) and the border of the plate (*b*). Messrs. Pfarre and Stohlmann, of the firm Tieman & Co., New York, have made such an instrument for me very neatly, which the accompanying full-sized cut represents. The plate is curved as in Snellen's modification, but instead of being iron, it is of tortoise shell, which does not give the patient a sensation of cold, nor dulls the edge of the knife in case the lid be pierced, as a metal plate would. It is fastened by two rivets (*c*) to the bevelled end (*d*) of the lower branch of the forceps, which is wedged into the edge of the tortoise-shell plate. The upper surface of this edge (*e*) projects over the handle of the lower branch in such manner that, when the forceps are closed by the screw, the upper surface of the plate is on a level with the half-ring.



This instrument is more serviceable than either Desmarres' or Snellen's. Its plate may be as long as the palpebral fissure. If a tumor is to be extirpated, only

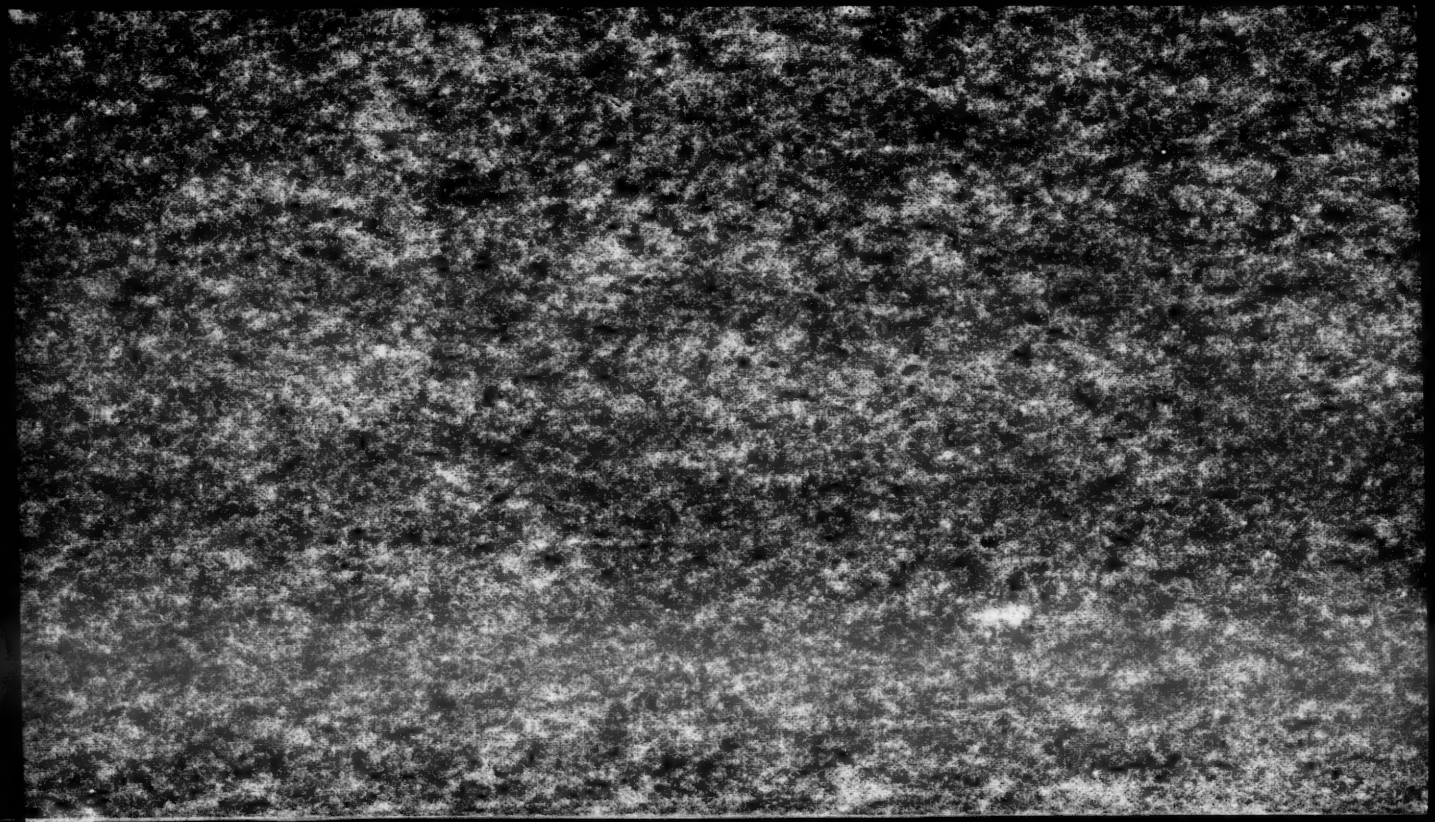
the anterior rounded angle of the instrument (near *m*) need be passed under the lid, but in cases of larger tumors or ectropium the whole plate is inserted between the eye-ball and the lid. When the half-ring is screwed down, the whole lid is extended and projects over the ring, thus facilitating the removal both of tumors and of integral parts of the lid. If the palpebral fissure be shortened, as in the majority of cases of entropium, the outer commissure should be divided previous to the insertion of the clamp. A piece of skin and muscle can then be easily removed from the whole length of the lid. The entire tarsal cartilage thus is not only laid bare, but rendered tight and prominent. Its grooving which is difficult and mostly unsatisfactory if done with the point of the knife, can now be accomplished readily and neatly by passing the whole cutting edge of a straight scalpel—which should be very sharp—along the convex surface of the cartilage from one side to the other. Thus it is as easy cleanly to excise a wedge-shaped slice from its outer layers as to remove the cartilage in toto or in portions of any size and shape. Hemorrhage is easily and completely arrested with the new instrument, which *bends and compresses* the lid between its ring and plate, whereas the old instrument acts by simple pressure. This improved clamp forceps may remain in position till the sutures are applied, and the whole operation is terminated. With its assistance operations for entropium can be very quickly performed.

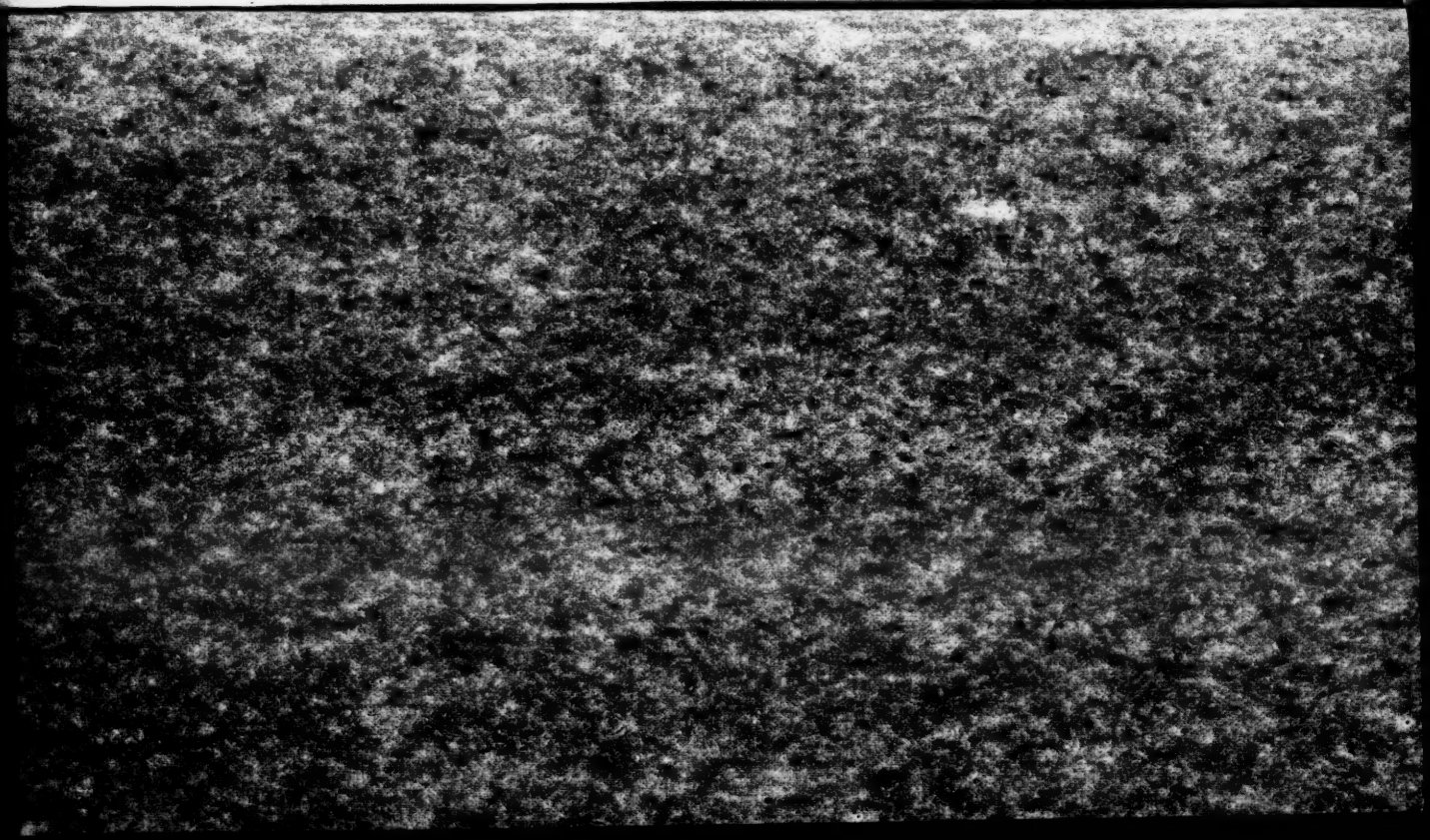
Like Snellen's clamp, the one above described can be used on one eye only. Lately I had another made, which is *applicable to both eyes.* It differs from the

former only in the direction of the handle, which is straighter downward, that is, forming an angle of about ninety degrees with the lower margin of the plate. The handle lies parallel with the nose, and neither it nor the screw is in the operator's way.—The modification of the clamp-forceps of Dr. J. S. PROUT, of Brooklyn, can be so changed that the half-ring will be larger than the plate. In Prout's lid-forceps, the branch with the half-ring turns on a horizontal axis at its lower end so that the ring may apply to either side of the tortoise-shell plate. The closure is effected by a double-headed pin, sliding along a slit-like opening in each branch of the forceps. The instrument is thus made applicable to both eyes; but the plain surfaces of its plate, and the want of a nice graduation of the pressure exerted by its closure, render it inferior to Snellen's forceps.

Messrs. Tiemann & Co., New York, make all the varieties of lid-forceps here mentioned. The instrument above described, consisting in having the half-ring larger and on a level with—not upon—the plate, may claim over the lid-clamps heretofore in use the following advantages:—

1. It controls hemorrhage more thoroughly.
2. It gives a larger space on which to operate.
3. It extends the parts to be removed, and renders them prominent and better exposed.





Tab. 4.

Fig. 1/3.

Fig. 2.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Tab. B.

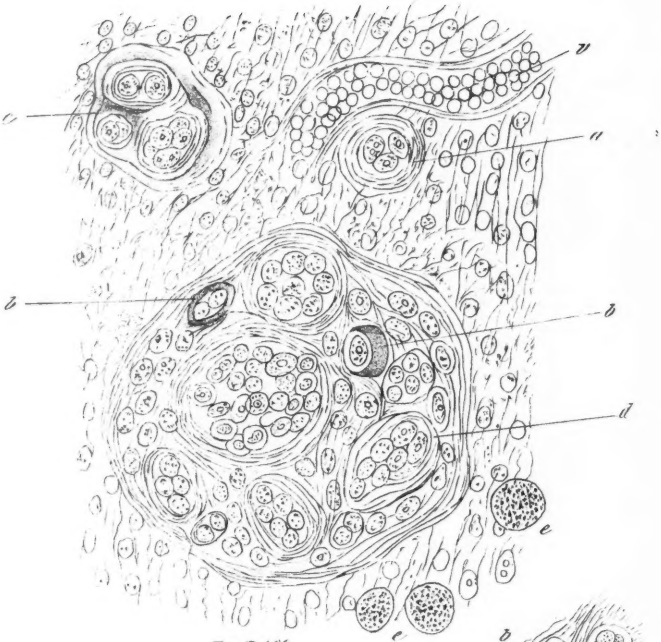


Fig. 7 4/1

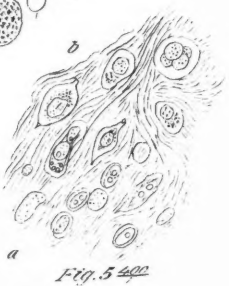
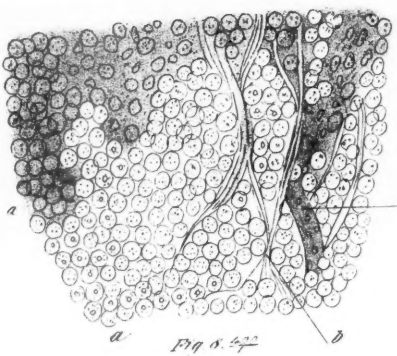


Fig. 5 4/0



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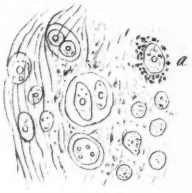

Fig. 6 4/0

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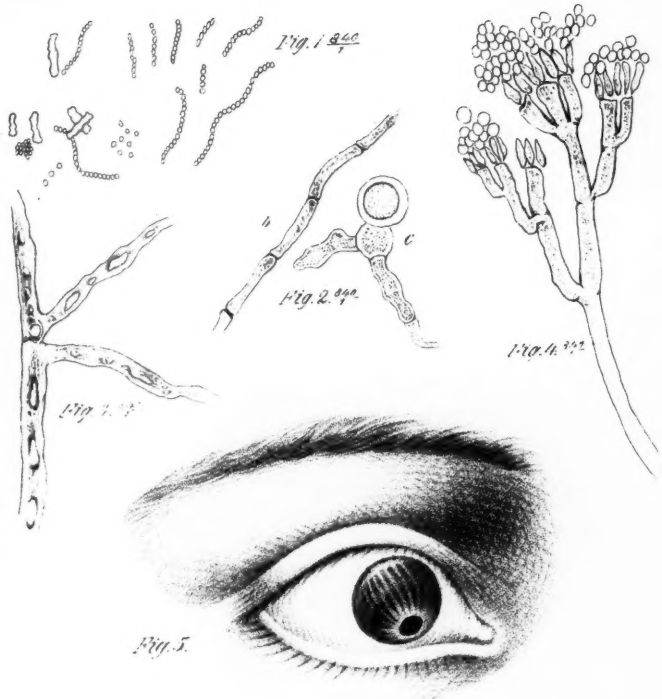

Fig. 1. $\frac{240}{1}$

Fig. 2. $\frac{240}{1}$

Fig. 4. $\frac{240}{1}$

Fig. 5.

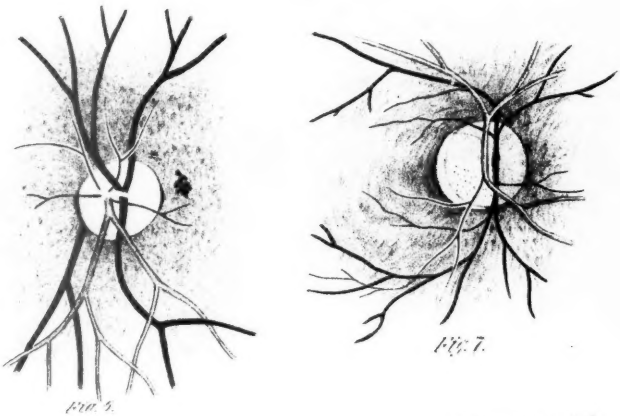

Fig. 6.

Fig. 7.

Tab. I.

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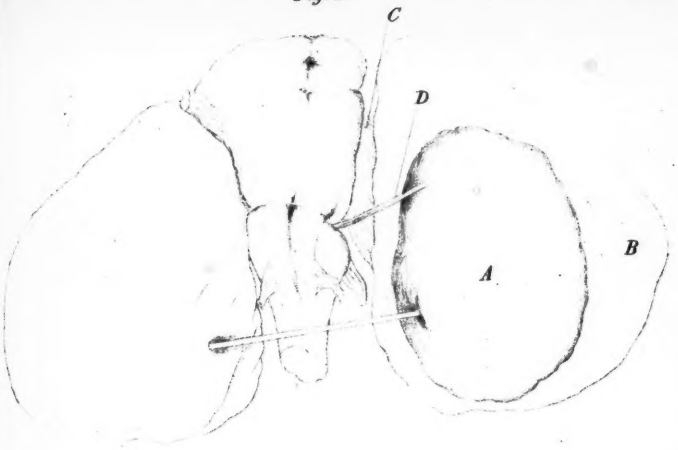

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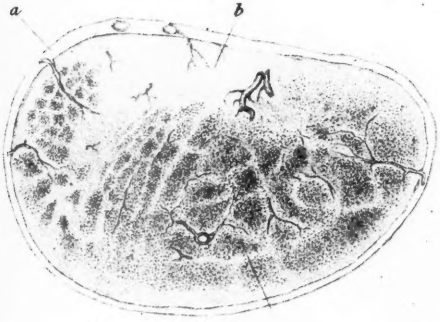

B.

Fig. 4.

Fig. 3.

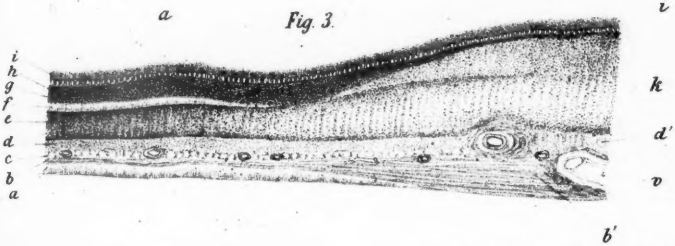

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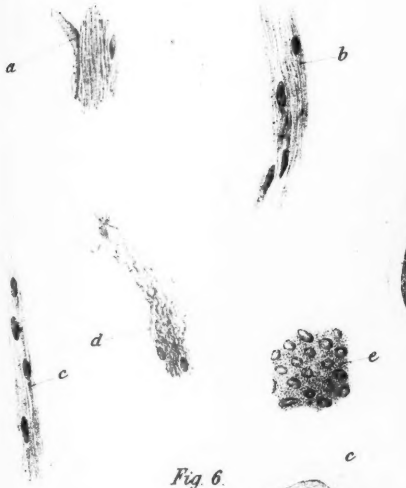
Fig. 8.



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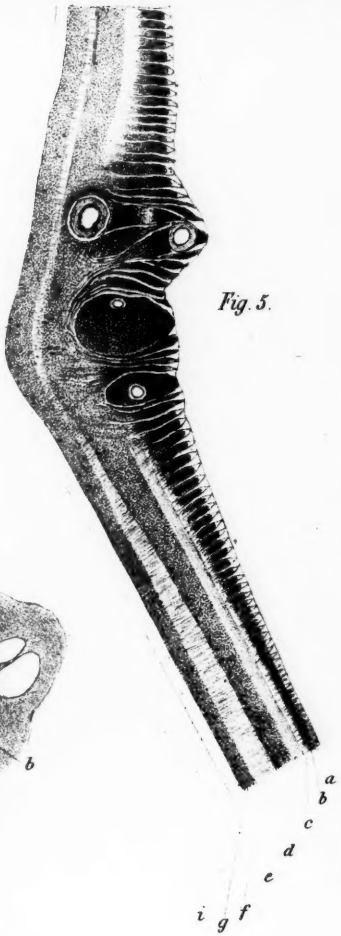

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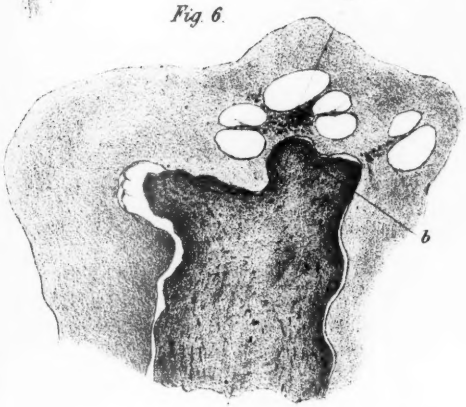

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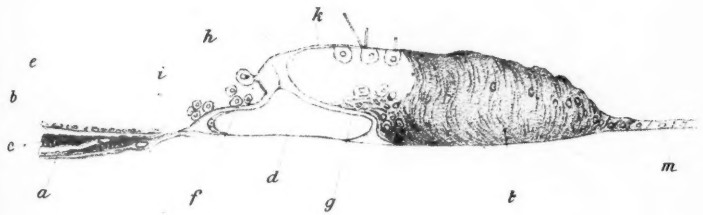

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